41 Spring St., Suite 102
New Providence, NJ 07974
T 908.988.1700
TRCcompanies.com

May 18, 2020

United States Environmental Protection Agency
Region 2
290 Broadway
New York, New York 10007-1866

Attn: Mr. Ricardito Vargas, Project Manager

Re: Final Supplemental Sediment Investigation Report
Former Chevron Perth Amboy Facility
1200 Maurer Road, Perth Amboy, New Jersey
Facility EPA ID #: NJD081982902
TRC Project No.: 326731/890

Dear Mr. Vargas:

On behalf of Chevron Environmental Management Company (Chevron), TRC Companies, Inc. (TRC) has prepared the enclosed report titled *Final Supplemental Sediment Investigation Report* (FSSIR) for review by the United States Environmental Protection Agency's (USEPA) and the New Jersey Department of Environmental Protection (NJDEP) for the former Chevron Facility (Facility) located in Perth Amboy, New Jersey. The FSSIR was completed in accordance with the *Supplemental Field Sampling and Analysis Plan* (SFSAP) approved by the USEPA/NJDEP in September 2019. The objective of the FSSIR is to meet the requirements of the Hazardous and Solid Waste Amendments (HSWA) Permit Renewal and Permit Modification I issued by the USEPA in 2013 to Chevron USA, Inc. – Buckeye Perth Amboy Terminal LLC (EPA I.D. #NJD081982902) as it pertains to the investigation of Facility-adjacent water bodies (Spa Spring Creek, Woodbridge Creek, and the Arthur Kill).

We believe the attached FSSIR completes Chevron's HSWA permit requirements for the water bodies and also facilitates the goal to meet the USEPA's RCRA CA 550 timeline objective for 2020.

As discussed during recent conference calls, Chevron anticipates presenting a summary of the FSSIR for the appropriate USEPA and NJDEP representatives, including field activities, laboratory analytical results and findings during a virtual meeting to be scheduled in the near future.

Please contact the undersigned if you have any questions and to discuss the timing for the proposed meeting.

Sincerely,

TRC ENVIRONMENTAL CORPORATION

William S. Cordasco
Senior Scientist
908-988-1626
wcordasco@trccompanies.com

Robert J. Lippencott, Ph.D., LSRP
Technical Director and Sr. Principal Consultant
908-988-1628
rlippencott@trccompanies.com

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Enclosures

Cc: Robert Mancini, Chevron
Charles Zelinski, NJDEP
Todd Frantz, Parsons

Final Supplemental Sediment Investigation Report

Former Chevron USA Facility
Perth Amboy, New Jersey

May 18, 2020

EPA ID No. NJD081982902

Prepared by:

William S. Cordasco, Sr. Technical Manager

Prepared For:

Chevron Environmental Management Company
1200 State Street
Perth Amboy, New Jersey 08861

Prepared By:

TRC Environmental Corporation
41 Spring Street
New Providence, New Jersey 07974

Reviewed and Approved by:

Robert J. Lippencott, Ph.D., LSRP, CHMM
Technical Director and Sr. Principal Consultant

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ATTACHMENT LIST

Attachment 1 Complete Copy of Sediment Investigation Report on (DVD)
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Attachment 3 Background Sediment Data 95UCL

ACRONYM LIST

amsl	Above mean sea level
AOC	Area of Concern
ASI	Aqua Survey, Inc.
ASTM	American Society for Testing and Materials
B(ghi)P	Benzo(ghi)perylene
BaA	Benzo(a)anthracene
BaP	Benzo(a)pyrene
BbF	Benzo(b)fluoranthene
BEE	Baseline Ecological Evaluation per NJDEP TRSR (circ. 2002-2003)
BkF	Benzo(k)fluoranthene
BN	Base Neutral
bpd	Barrel per day
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CALOIL	California Oil Company
CAMU	Corrective Action Management Unit
CEMC	Chevron Environmental Management Company
Chevron	Chevron USA
COPEC	Contaminant of Potential Ecological Concern
DAP	Diffuse Anthropogenic Pollution
D(ah)A	Dibenz(a,h)anthracene
DEHP	Bis(2-Ethylhexyl)phthalate
DO	dissolved oxygen
EETG	Ecological Evaluation Technical Guidance
EM	Electro-magnetometer
EPH	Extractable Petroleum Hydrocarbons
ER-L	Effects Range-Low
ER-M	Effects Range-Medium
ESC	Ecological Screening Criteria
Eurofins	Eurofins Lancaster Labs Environmental, LLC
FSSIR	Final Supplemental Sediment Investigation Report
HSWA	Hazardous Solid Waste Amendment
mg/kg	milligram per kilogram
NJDEP	New Jersey Department of Environmental Protection
PAH	Polycyclic Aromatic Hydrocarbon
PAH	Polycyclic Aromatic Hydrocarbon
PAOC	Potential Area of Concern
ppt	parts per thousand
RCRA	Resource Conservation and Recovery Act
RTC	Response to Comments

SEE	Supplemental Ecological Evaluation
SOCAL	Standard Oil of California
SRFI	Supplemental RCRA Facilities Investigation
SRP	Site Remediation Program
SRU	Sulfur Recovery Unit
SSG	Sediment Screening Guidelines
SSHEP	Site-Specific Health and Safety Plan
SSI	Supplemental Sediment Investigation
su	Standard Units
SVOC	Semi-Volatile Organic Compound
SW	Surface Water
SWMU	Solid Waste Management Unit
SWQS	Surface Water Quality Standards
TAL	Target Analyte List
TCL	Target Compound List
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TRC	TRC Environmental Corporation
TRSR	Technical Requirements for Site Remediation
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

FINAL SUPPLEMENTAL SEDIMENT INVESTIGATION REPORT
FORMER CHEVRON PERTH AMBOY FACILITY
PERTH AMBOY/WOODBRIDGE, MIDDLESEX COUNTY, NEW JERSEY
EPA ID No. NJD081982902
May 18, 2020

1.0 Introduction

TRC Environmental Corporation (TRC) on behalf of Chevron USA (Chevron) has completed the investigation of water body sediments at the former Chevron Facility located in the City of Perth Amboy and Woodbridge Township, Middlesex County, New Jersey (the Facility). Water Bodies adjacent to the Facility that are the subject of this investigation include Spa Spring Creek, Woodbridge Creek, and the Arthur Kill (Figure 1). The most recent field activities included the implementation of the Supplemental Sediment Investigation (SSI) of Woodbridge Creek and Spa Spring Creek, completed in October 2019, that addressed data gaps and other concerns that were identified based on comments received from the United States Environmental Protection Agency (USEPA) and the New Jersey Department of Environmental Protection (NJDEP) regarding earlier surface water and sediment investigations conducted in 2002 and 2014 at the Facility. An overview plan of the Facility shows the location of the adjacent water bodies and sediment sample locations (Figure 2).

This Final Supplemental Sediment Investigation Report (FSSIR) incorporates the data from three prior investigative phases, including field and laboratory analytical results, and provides a comprehensive evaluation of sediment conditions to meet the requirements of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) of adjacent water bodies. The first of these surface water and sediment investigations for the three water bodies was performed as part of the full site-wide RFI field investigation, completed in 2002. The results of the 2002 RFI were included in the November 2003 RFI Report (Section 9 – *Baseline Ecological Evaluation* [BEE]). Information for the first phase of the water body surface water and sediment investigation completed in 2002 that informed the 2003 RFI report is included in Appendix A. Further investigation of water body sediment for the three water bodies was conducted in 2014 under a second phase of sediment investigation implemented to address data gaps subsequently identified in the RFI by the USEPA/NJDEP, with related findings reported in the November 1, 2016 Supplemental Ecological Evaluation Report (SEER). Information for the second phase of the sediment investigation completed in 2014 that informed the SEER is included in Appendix B.

On August 31, 2018, the USEPA/NJDEP provided comments regarding the 2016 SEER that included requests for further sediment investigation. Chevron met with the USEPA/NJDEP on September 17, 2018 to review the comments and discuss the next steps. In November 2018, Chevron submitted a Supplemental Field Sampling and Analysis Plan (SFSAP) to the USEPA and NJDEP addressing their comments regarding the SEER and proposing further investigation of sediments in Spa Spring Creek and Woodbridge Creek. The SFSAP was revised based on comments from the USEPA/NJDEP provided in March 2019 and during subsequent meetings, conference calls, email and responses to comments (RTCs) submitted to the USEPA by Chevron (directly or via TRC) in July, August and September 2019.

The revised SFSAP (an aggregate of the various versions of the November SFSAP, meetings, correspondences and RTCs) was approved by the USEPA on September 19, 2019, and implemented as the third phase of the sediment investigation, completed in October 2019 and described in the Supplemental Sediment Investigation Report (SSIR; included as Appendix C). Selected historical information and key documents, including historic maps of the Facility and surrounding areas, historic aerial photographs, historic spill information for adjacent sites, and utility mapping is provided in Appendix D. As specified in the July 2019 SFSAP, laboratory analytical data for soil and groundwater samples collected from locations within 200 feet of the adjacent water bodies are provided in Appendix E. Details regarding the prior investigation activities, and associated reports and key correspondences, are described further in this FSSIR. Attachment 1 is a complete electronic copy of the FSSIR on DVD including Electronic Data Deliverables (EDD) and Laboratory Reports. Selected USEAP/NJDEP correspondences related to the SFSAP and FSSI are included in Attachment 2. A summary of key submissions and regulatory correspondence is provided in Section 3, below.

The FSSIR completes the requirements of the Hazardous and Solid Waste Amendments (HSWA) Permit Renewal and Permit Modification I issued by the USEPA in 2013 to Chevron USA, Inc. – Buckeye Perth Amboy Terminal LLC (EPA I.D. # NJD081982902). The 2013 HSWA Permit was issued by the USEPA pursuant the RCRA requirements, including completion of the investigation RFI for the three adjacent water bodies[1]. The 2003 RFI was completed pursuant to the original HSWA Permit for the Facility issued in 1994, while the 2016 SEER was completed under the 2013 HSWA Permit Renewal and Permit Modification 1 (HSWA Permit Modification).

1.1 Purpose and Objectives

The purpose of the FSSIR is to provide sufficient information to complete the compliance requirements of the HSWA Permit Modification for the investigation of the subject water bodies. The overall objective of the sediment investigation was to determine the extent and nature of sediment contamination in waterbodies adjacent to the Facility. Sediment contamination in the three surface water bodies was first identified in the 2003 RFI report. The specific objective of the 2019 sediment investigation, as noted in the approved SFSAP, was to address the limited data gaps remaining after completion of the preceding investigation phases and associated reports (2003 RFI, 2016 SEER). Additional sediment samples were collected in 2019 at previously sampled locations, and at additional sampling locations. The additional sediment samples were collected to fill data gaps, to further characterize sediment conditions in background reaches of Woodbridge and Spa Spring Creeks, and to provide more data where deemed necessary to evaluate sediment conditions proximal to known areas of historical Facility upland contamination (Figure 2A). These upland areas included Areas of Concern (AOCs), areas where Light, Non-Aqueous Phase Liquids (LNAPL) were proximal to water bodies, and historic discharge locations as requested by USEPA/NJDEP.

[1] See 2013 HSWA Permit, Module III, Condition B.2. Page 25 and 26

2.0 Environmental Setting

2.1 Site Description

The 368-acre Facility is located near the confluence of Woodbridge Creek and the Arthur Kill in an industrial area within the City of Perth Amboy and Woodbridge Township, Middlesex County (Figure 1). The bulk of the Facility property is now owned by Buckeye Pipeline as the Buckeye Perth Amboy Terminal, whereas Chevron retains ownership of only a small portion of the Facility including the Corrective Action Management Unit (CAMU) located in the northern portion of the Facility (Figures 2 and 2A), closed Surge Pond and constructed wetland area. The CAMU consists of engineered containment cells for remediation wastes associated with past operations as approved in the 2013 HSWA Permit Modification. . The areas retained by Chevron include portions of Block 478.02, Lot 2 in the City of Perth Amboy, and Block 523, Lot 3.01 in Woodbridge Township. However, for purposes of the HSWA Permit and this report, the Facility includes all portions of the area identified within the boundaries shown on the figures regardless of ownership. The active portions of the Facility are operated by Buckeye and include pipelines and bulk aboveground tanks for distribution and storage of petroleum products, waterfront docking facilities for bulk petroleum tankers, and other related infrastructure (e.g., utilities, roadways, storage areas, wastewater treatment plant). Historical site conditions and past operations are further discussed below in Section 3.

2.2 Topography and Drainage

The original topography at the Facility was historically altered by fillinggrading and installation of a bulkheaded waterfront along the Arthur Killto accommodate industrial development. The Facility is located in the Coastal Plain physiographic province of New Jersey, which typically consists of broad areas of level terrain drained by low-gradient streams that flow to the Atlantic Ocean either directly, or through its inland extensions (bays, straits). The topography at the Facility is essentially flat, with elevations ranging from approximately 13 feet above mean sea level (amsl) in the far northwestern portion, to approximately sea level along the Arthur Kill, which receives limited drainage from the Facility via Woodbridge Creek (Figure 1).

Information regarding stormwater management and discharges prior to 1950 is sparse. However, general stormwater and wastewater management operations can be divided into three main periods: (1) prior to 1976; (2) between 1976 and 1987; and (3) after 1987. These divisions are based upon the construction of the current Effluent Treatment Plant (ETP) in 1976 and the removal of the stormwater surface impoundments from service in approximately 1987. Stormwater and wastewater from several solid waste management units (SWMUs) was historically discharged after some form of treatment (e.g., via oil-water separation). The locations of these areas are presented on Figure 2A along with proximal sediment sampling locations. (Details regarding historical discharges and past operations were provided in the July 2019 SFSAP.)

Currently, stormwater runoff from the Facility is largely controlled by a network of catch basins and storm sewer piping, and generally flows into the oil water separator system (OWSS). The OWSS is connected to the ETP that discharges treated effluent to Woodbridge Creek. The discharge is regulated under a NJPDES-DSW permit. As a result, very little incidental precipitation that falls along the banks of the adjacent water bodies and stream corridors actually reaches the surface water. Based on several site inspections conducted during the RFI and subsequent investigations, there are no significant stormwater discharge pathways from the Facility (including AOCs, SWMUs, and LNAPL areas) to the adjacent surface water bodies.

The BEE for the Facility was completed in 2003 and described in Section 9 of the RFI Report. As part of the BEE process, environmentally sensitive receptors were identified, including Spa Spring Creek, Woodbridge Creek, and the Arthur Kill. In addition to reviewing available information and mapping to identify potential receptors, threatened or endangered wildlife, and related data, the BEE included a review of the laboratory analytical results for sediment and surface water samples collected from the adjacent water bodies during the 2002 RFI. The analytical results were compared to the ecological criteria for sediment and surface waters, and an assessment was performed to determine the potential for migration of contaminants detected in Facility soil and groundwater to impact the water bodies. The BEE concluded that, under current conditions, the potential for contaminants to enter sediment and surface waters via groundwater flow and surface runoff was low. The BEE determined that no further investigation of surface waters was required, but that further evaluation of sediments was warranted.

2.3 Surface Water Features

The surface water bodies bordering portions of the Facility and draining adjacent areas have been evaluated as environmental receptors since the 2002 RFI. They include Spa Spring Creek to the north, Woodbridge Creek to the north/northeast, and the Arthur Kill to the east (Figures 1 and 2). The Arthur Kill is a tidal straight separating New Jersey and Staten Island, New York. Woodbridge Creek is a tidal, brackish-saline estuarine water body that flows past the Facility to the Arthur Kill. Spa Spring Creek below the railway culvert west of the Facility is a tidal, brackish but is a freshwater, non-tidal stream in the reach upstream of the culvert (Figure 2). The Arthur Kill is subject to the tidal influence of the Atlantic Ocean, with overall flow affected by input from freshwater tributaries and the Kill van Kull separating Staten Island from Hudson County, New Jersey. Water flow and elevation in Woodbridge Creek and Spa Spring Creek are also influenced by the tides, and to a lesser extent by precipitation except for the non-tidal reach of Spa Spring Creek.

As noted further in the FSSIR, the sediments investigated in 2002, 2014, and 2019 consist of the upper clay, silt, and sand materials recently deposited at the bottom of the water bodies since the industrial development of the Facility and surrounding region. These sediments are not associated with the deeper, more consolidated marine clays or glacial till underlying the region and are collectively referred to as the “soft” sediments. The thickness of the soft sediment generally thins with distance from the Arthurk Kill, and is thinnest in Spa Spring Creek.

The Arthur Kill is part of the New York-New Jersey Harbor complex and connects the Kill van Kull and Newark Bay to the north with Raritan Bay and the Raritan River to the south (Figure 1). As noted in the 2003 RFI report, tidal surges come from both the Kill Van Kull/Newark Bay and the Raritan Bay/estuary, with an average flushing time of two weeks and an average semi-diurnal tidal range of 1.6 meters (5.3 feet). The major freshwater inputs are the major tributaries of the Arthur Kill: the Rahway River, the Elizabeth River, and the Fresh Kills, which contribute about 38 percent (122 cubic feet per second (ft^3/sec)), with the balance of 62 percent (200 ft_3/sec) coming from smaller tributaries, sewage treatment plants, combined sewer overflows, and industrial discharges. The salinity of the Arthur Kill varies from 17 to 27 parts per thousand (ppt) at the southern end to nearly freshwater in some of the tributary mouths. The Arthur Kill is an important industrial/commercial water body and is surrounded by one of the most densely populated coastal areas in the world. According to the United States Fish and Wildlife Service, there is a concentration of industrial uses adjacent to the Arthur Kill, especially for port facilities and petroleum and chemical industries[2]. Significant modifications of the physical features of the Arthur Kill and its tributaries were made to serve the maritime transportation and related industries in the New York/New Jersey harbor area, beginning in the mid-late 1800s. The highly industrialized water body is dredged to maintain the shipping channel, which has been deepened in recent years. Much of the shoreline is comprised of bulkheads or rip-rap.

Land use along the Arthur Kill includes railroad yards, petro-chemical bulk storage and transfer facilities, bulkheads, docks, road systems, New York City's Freshkills landfill, power plants, petroleum refineries, chemical plants, and other industrial, commercial, and residential land uses. Prior to the advent of the NJPDES permit program, Chevron discharged treated storm water to the Arthur Kill at the approximate location of the former East Yard separator. Conditions in the Arthur Kill beyond the periodically dredged near-shore and berthing areas are also subject to periodic dredging for channel maintenance (e.g., by the U.S. Army Corps of Engineers), and sediment disturbance/scour by large ships and strong currents. As a regional water body with multiple tributaries, discharge points, and regional contaminant contribution, further assessment of sediment conditions was not conducted, as described further in this report.

Spa Spring Creek is a tributary that flows, generally, from west to east and discharges to Woodbridge Creek above the constructed wetland project area (former location of the Northfield Basin) (Figure 2). It is also classified by the NJDEP as a Saline Estuary /Freshwater Non-Trout stream (SE3/FW-NT) water due to its transition from a freshwater non-trout stream to a brackish stream where it flows along the northern boundary of the Facility. Observations of Spa Spring Creek over several tidal cycles during the 2019 investigation indicates that tidal influence appears to end at the Pennsylvania Railroad culvert to the west of the Facility. The reach of Spa Spring Creek along the Facility's northern border consists of a /historically re-aligned channel that empties into Woodbridge Creek. Immediately upstream of the Facility, Spa Spring Creek flows through an industrial area and below Amboy Avenue. Upstream of Amboy Avenue, Spa Spring Creek drains an urban residential area. Prior to its re-alignment along the Facility's northern boundary, Spa Spring Creek naturally flowed through the location of the former North Field Basin (Chevron's tidal wetlands restoration project area). Chevron previously discharged site runoff to Spa Spring Creek under a New Jersey Pollution Discharge Elimination System (NJPDES) permit at former outfall point DSN-004 (Figure 2).

Woodbridge Creek is a meandering tidal stream that flows south from its freshwater source approximately 5 miles north of the Facility to its confluence with the Arthur Kill. Woodbridge Creek is bounded by mudflats and tidally-flowed wetlands, as well as numerous residential, industrial, commercial, and abandoned properties. In the past Woodbridge Creek was a commercially navigated water body serving at least one former industrial site immediately upstream of the Facility. The NJDEP classifies Woodbridge Creek as SE3/FT-NT (saline estuary-freshwater non-trout); the SE3/FW-NT designation reflects the creek's progression from a freshwater stream in

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[2] United States Fish and Wildlife "SIGNIFICANT HABITATS AND HABITAT COMPLEXES OF THE NEW YORK BIGHT WATERSHED Arthur Kill Complex" see https://nctc.fws.gov/resources/knowledge-resources/pubs5/web_link/text/akc_form.htm

its upstream reach, to a saline stream as it approaches the Arthur Kill. Several wetland restoration projects have been conducted along its banks. At normal high tide, Woodbrdige Creek is approximately 100 feet wide in the reach near the Facility. Woodbridge Creek converges with the Arthur Kill several hundred feet north of the Facility's East Yard. While its shoreline is not as developed as the Arthur Kill, the Woodbridge Creek watershed has a long industrial history. Petroleum facilities, chemical plants, metal recycling plants, brick manufacturing plants, an industrial landfill and a commercial hazardous waste reprocessing plant were historically present along the banks of Woodbridge Creek proximal to the Facility[3][4][5]. Appendix D provides a historical narrative and related maps and aerial photographs of the Facility and surrounding areas.

2.4 Geology and Hydrogeology

Information on the geology and hydrogeology was obtained from prior subsurface investigations conducted at the Facility and review of published geologic information included as part of the 2003 RFI Report. The general stratigraphy of the Facility consists of six major units which overlie the bedrock, including fill, organic clay and peat, glacial till and outwash, and Raritan Formation sand and clay. The surface and shallow soils are composed of fill (i.e., Historic Fill Material [HFM]) over large portions of the Facility, which is generally less than ten feet thick, but can be up to 20 feet thick. In some areas, the fill appears to be derived from on-site glacial deposits, and consists largely of sand, with variable amounts of silt, clay and gravel. Non-indigenous material in some areas of the fill includes miscellaneous debris, ash, construction debris, and catalyst beads. Fill was placed directly on top of marshland and other existing native soils before the construction of surface impoundments during the 1960's, and fill was used to build up dikes around the edges of the bulk storage tank impoundments. A map showing the regional HFM near the is included in Appendix D. Clay soils beneath the site include the Raritan Fire Clay ranging in thickness from 12 to 20 feet and the Woodbridge Clay, which is less than 50 feet thick. The Farrington Sand is 15 to 25 feet thick and is continuous beneath the site, except at the eastern section adjacent to the Arthur Kill, where it was apparently removed by erosion.

Bedrock was encountered in several deep borings at the Facility from 65 to 85 feet bgs. There is a layer of saprolite that overlies competent bedrock, which formed from well-weathered and decomposed rock (either diabase or mudstone of the Lockatong Formation). The saprolite grades upward into the Raritan Fire Clay without a distinct contact. The saprolite appears to be laterally continuous across the site and is typically up to five feet thick.

2.5 Site Hydrogeology

The upper water bearing unit at the Facility is an unconfined shallow water bearing zone that is present within the fill layer. A middle water bearing zone is present within the glacial outwash deposits. The lower water bearing unit is the Farrington Sand, which has been used in the past in the Perth Amboy area as a local public water supply source, but is no longer used for these purposes.

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[3] See aerial photos from 1972 and 1978 in Appendix D.

[4] USEPA Region 2 RCRA Corrective Action Environmental Indicator (EI) report, June 12, 2008 for the CP Chemicals Facility (EPA Facility ID# NJD002141950) located across Woodbridge Creek from the Facility acknowledges "the industrialized nature of Woodbridge Creek".

[5] 2003 RFI Report Section 9.1.2 (enclosed in Appendix C)

In the northern and eastern areas of the Facility, the upper water bearing zone in the fill is separated from the water bearing zones in the glacial outwash and Farrington Sand (where present) by the organic clay unit. In the southern and western areas of the Facility, the organic clay unit pinches out and the water bearing zone in the fill is underlain by the glacial till, or glaciolacustrine clays. The Farrington Sand is further isolated from groundwater within the fill by the Woodbridge Clay. The low permeability clays and silts that separate the permeable water bearing zones are discontinuous.

In general, groundwater is encountered at depths ranging from two feet bgs in the low-lying areas of the Facility, to an approximate maximum depth of 10 feet bgs in the areas of higher elevation. Site data indicate that hydraulic communication between the permeable zones is limited where the intervening low permeability units are present. Historical water level elevations from nested or closely spaced wells screened in the shallow and deep zones vary by as much as four feet. Groundwater flow direction also varies between the zones. Based on limited historical data, the groundwater in the Farrington Sand beneath the Refinery generally flows to the east or southeast, which is similar to the regional flow pattern. Historical data collected from nested monitoring wells indicates that there is an upward hydraulic gradient from the native clays and glacial units below the fill towards the water bearing unit in the fill.

Tidally influenced groundwater level fluctuations and saltwater intrusion into the shallow water bearing zone have been observed and documented in the areas near Woodbridge Creek. Data from wells in the Northfield Basin area have shown a tidally related groundwater elevation fluctuation of up to 1.5 feet. In contrast, monitoring wells in the East Yard area have shown little tidal influence. This limited tidal influence in the East Yard is attributed to the bulkheads that have been placed along the Arthur Kill. Saltwater intrusion into the Farrington Sand has been documented in the area south of Woodbridge Creek at and near the Facility and has been classified pursuant to NJ Ground Water Quality Standards (N.J.A.C. 7:9C as GW III-B (unsuitable for potable use due to naturally occurring saltwater intrusion)

2.6 Conceptual Site Model

For the purpose of this report, a Conceptual Site Model (CSM) is included as Figure 2B and provides a generalized illustration of sediment stratigraphy, input mechanisms affecting the adjacent water bodies, and hydrologic features, focusing on Woodbridge Creek which is the primary receptor. The CSM also provides a graphical representation of the sediment conditions described further in the FSSIR, notably the extent of the distinctive “soft” sediments, and the isolated nature of the limited LNAPL present in the fill and soil material at the Facility and subject to on-going recovery and monitoring. These conditions were presented to the USEPA/NJDEP during the August 7, 2019 meeting, and further detailed in the August 21, 2019 RTC letter from Chevron which was included as part of the approved July 2019 SFSAP by the agencies. Regarding the physical delineation of contaminated soft sediments:

- The extent of soft sediment is defined horizontally by the banks of each water body and vertically by refusal on the underlying till/alluvium;
- The bathymetric survey and lithologic profile for the mouth of Woodbridge Creek, as presented on the Bathymetric Survey and lithologic profile included in the (November 2016 SEER indicates that soft sediment does not extend into the Arthur Kill; and,
- The absence of soft sediment in the Arthur Kill is attributable to tidal scouring, periodic dredging/channel deepening, and large vessel propeller effects.

The laboratory sample analytical results provide a basis for characterization of the soft sediments within the limits of the water bodies. However, except for in the upstream direction, the delineation of water body soft sediment is a function of the physical water body limits (e.g., banks) and the extent of the downstream limit of the soft sediment (i.e., based on presence/absence and bathymetry, per the SEER). Sections 3 and 5 of the FSSIR provide additional details regarding the physical delineation of the soft sediment associated with the detected contaminants and LNAPL.

Beginning in the 1990s, LNAPL areas have been subject to interim remedial measures pursuant to the HSWA Permit. Regarding the LNAPL, it was noted that the LNAPL areas have been significantly reduced in mass and extent, that LNAPL is immobile, with a viscosity similar to motor oil, and that the reduced LNAPL areas are not historic or current sources of sediment contamination to adjacent water bodies. As noted in the 2003 RFI Report, the approved SFSAP, and the July and August 2019 RTC letters from Chevron to the USEPA/NJDEP, the LNAPL areas were previously defined, are currently undergoing remediation, and do not have a complete migration pathway to the environmentally sensitive natural resources (i.e., the water bodies). It should be noted that LNAPL conditions have further improved (reduced) over the intervening 17 years. The SFSAP included information from the annual LNAPL monitoring reports submitted by Chevron to the USEPA and NJDEP from the 1990s through 2019. These reports have been approved and indicate that no impacts to the adjacent surface waters are associated with the LNAPL areas. Monitoring wells in/near LNAPL areas have been periodically gauged as part of the annual program to determine LNAPL presence and thickness on the groundwater surface, with results indicating a decline in LNAPL thickness and extent. The lack of historical or current LNAPL migration to the surface water bodies described in the 2003 RFI report is supported by the intervening LNAPL monitoring and recovery data obtained since that time, and by the findings of the subsequent water body sediment investigations.

Based on the CSM and as noted in the findings of the 2002, 2014, and 2019 investigations, the characterization of soft sediment in Facility-adjacent water bodies has been completed. The results of the investigations indicate that there are no migration pathways from the Facility to the adjacent water bodies, and the extent of soft sediments containing COPECs has been delineated.

3.0 Summary of Facility History

This section provides a summary of the Facility's history; additional historical details are provided in prior reports.[6][7] The Regional Development and Facility History was described in prior documents including the approved SFSAP, the 2003 RFI and the 2014 SEER. The development of the Facility and the surrounding region is summarized in greater detail here to provide a contextual background for the sediment investigation that considers the extensive alteration of the natural environmental conditions. Additional information regarding the Facility operational history, historical maps and aerial photographs are included in Appendix D.

3.1 Regional Industrial and Urban Development

The region surrounding the Facility has undergone intensive development over the past 150 years. Industrial and commercial development in turn resulted in the need for urban infrastructure and residential construction, and the region remains highly urbanized. An extensive network of roadways, freight and passenger railways, and port facilities was developed in this portion of Middlesex County and nearby areas to support the needs of local industries and residents. Historic aerial photographs and maps showing the location of selected active and inactive industrial sites in the vicinity of the Facility are provided in Appendix D.

The following industries, land uses, and other features were historically located near the Facility and within the Rahway River/Woodbridge Creek Watershed and adjacent areas. The location of these industries was obtained from the Sanborn Fire Insurance Maps reviewed as part of the 2003 RFI, and aerial photographs included with the 2019 SFSAP. Although there has been a shift from refining and other heavy industry to commercial warehousing and distribution facilities, some of the industries listed below remain active in the surrounding region.

- Brick manufacturing – examples include the Excelsior (Maurer) Brick Works formerly present on the Facility property, and the Valentine Fire Brick Company
- Asphaltic materials manufacturing (including roofing, roadway materials, etc.) including the former west-adjacent Keasby and Mattison Company Plant No. 5, and the Barber Asphalt Company formerly on Facility property.
- Petroleum refining, storage, distribution – examples include the adjacent Shell-Motiva and former Hess facilities.
- Metallurgical facility (smelting and metal refining) examples include the south-adjacent American Smelting and Refining Company (ASARCO) site and the Vulcan Metal Refining Company (later CP Chemical) site located opposite the Facility across Woodbridge Creek.
- Chemical manufacturing – the CP Chemical Corporation located opposite the Facility and across Woodbridge Creek, and the former American Cyanamid Corporation site located northwest of the Facility.

[6] RFI Report, Section 2, November 2003
[7] Supplemental Field Sampling and Analysis Plan, July 2019

- Transportation – New Jersey Turnpike, State Street, Amboy Avenue, Woodbridge Avenue, Pennsylvania and Jersey Central Railways, maritime shipping (Arthur Kill and Woodbridge Creek).
- Porcelain, Tile, and Ceramic Works
- Waste Disposal – examples include the former Bird and Sons Landfill, and the American Cyanamid Landfill.
- Historic Fill Material (HFM) has been placed over much of the Woodbridge Creek watershed to accommodate urban development, including much of the Facility's land area.

Several current or former industrial facilities are located immediately adjacent to the Facility including the former Amerada Hess bulk petroleum storage and distribution facility, the former American Steel and Refining Company (ASARCO), the former Shell (now Motiva) bulk petroleum storage and distribution facility and the former American Cyanamid chemical manufacturing plant. The former CP Chemical plant, a commercial hazardous waste facility, operated directly across Woodbridge Creek from the facility. The former Hess and the Shell/Motiva sites front both the Arthur Kill and Woodbridge Creek, the ASARCO site is located to the south on the Arthur Kill, while the former American Cyanamid site is along Spa Spring Creek to the north of the Facility. Several small automotive and other businesses were formerly located along State Street adjacent to the Facility's Central Yard. Information regarding potential environmental issues related to their operation were documented in the Description of Current Conditions (DOCC) report prepared August 24, 1994 and included with the approved SFSAP. A summary is also included in Appendix A of the FSSIR (2003 RFI Report Section 9).

The location of the former Chevron facility within a highly urbanized-industrial region of New Jersey is of particular importance with respect to the presence of background contamination, including Diffuse Anthropogenic Pollution (DAP) and its relation to COPECs detected in sediments. DAP is defined as "contamination from broadly distributed contaminants, often arising from multiple sources" (NJDEP *Diffuse Anthropogenic Pollution (DAP) Administrative Guidance* – Version 1.1 April 30, 2013). Historic Fill Material (HFM), defined in the NJDEP's *Historic Fill Material Technical Guidance* (Version 2.0, April 29, 2013) has been identified on and adjacent to the Facility and is similarly important with respect to the presence of certain COPECs.

3.2 History of Chevron Operations

This section summarizes the history of the Facility including periods prior to, during, and following Chevron's operational tenure. Additional details on the history of the area in and surrounding the Facility can be found in the 2003 RFI Report, the 2016 SEER, and the SFSAP, as well as other documents noted in this section and listed in the References. The majority of the former Chevron Facility is situated within the City of Perth Amboy, and a smaller portion in the Township of Woodbridge in Middlesex County, New Jersey (Figure 2). The former Facility received heavy crude oil from tankers that was refined into finished asphalt cement, and intermediate products.

The Facility was operated initially as Standard Oil of California (SOCAL) beginning in the mid-1940s. SOCAL expanded the Facility and refined a variety of petroleum products from this period through 1994. Bulk aboveground storage tanks, product transfer piping, an asphalt plant and refining infrastructure, marine docking and loading areas, a power generation facility, and support infrastructure were constructed and operated during the last half of the 1900s. The Facility expanded to its maximum extent, 368 acres, by the mid-1990s. The operating Facility consisted of six operating areas or yards including the Central Yard, East Yard, North Field/Main Yard (Main Yard), West Yard, and Amboy Field.

The gradual reduction and cessation of Facility operations began in the mid-1990s, coinciding with an increase in environmental control and remediation activities. Over the past 20 years, portions of the main areas of the Facility, and the former West Yard and Amboy Field sections have been decommissioned and sold to others for the construction of commercial warehousing as part of the City of Perth Amboy's redevelopment efforts. In 2012, Chevron sold most of the remaining three yards (Main, Central, East) to Buckeye Perth Amboy Terminal, LLC. Chevron retains ownership of a small portion of the northern part of the Main Yard containing the RCRA Corrective Action Management Unit (CAMU). Currently, Chevron's operations are limited to management and oversight of environmental remediation programs, which have either been completed or will be completed in the near future and include:

- Soil remediation including in-situ treatment, capping, and excavation/disposal.
- Construction of the RCRA CAMU to permanently contain site-related remediation wastes.
- Groundwater remediation including vapor extraction, injection of treatment amendments, remedial pumping/treating, containment, and long-term monitoring.

While not performed for remediation purposes, sediment was dredged from the marine berthing areas in 2003 and used to backfill former remedial excavations in the East Yard. The dredging was completed under a permit from the NJDEP's Office of Dredging and Sediment Technology.

3.3 Summary of Water Body Regulatory and Investigation History

The FSSIR was completed with respect to discussion and correspondence with the USEPA and NJDEP over a 16-year period. The below-listed submissions and correspondence comprise the written record of regulatory discussions and resulting key decisions that guided the preparation of the FSSIR:

Key Submissions and Regulatory Correspondence

Date	Document
September 20, 2019	USEPA and NJDEP revised SFSAP approval letter
August 21, 2019	TRC letter to USEPA regarding August 7, 2019 Meeting and Presentation of the Revised SFSAP
August 7, 2019	Meeting between NJDEP, USEPA, Chevron, Buckeye Pipeline TRC regarding SFSAP
July 2, 2019	Response to USEPA's March 1, 2019 Comments on SFSAP
July 1, 2019	Submission of Revised SFSAP
March 1, 2019	USEPA/NJDEP Comment Letter on Nov. 2018 SFSAP
November 15, 2018	Submission of response to August 31, 2018 comments and SFSAP to USEPA
September 17, 2018	Meeting between USEPA, TRC, Chevron
August 31, 2018	USEPA issues comments regarding Chevron Water Body Sediment Sampling and additional investigation to meet RFI requirements.
July 31, 2017	Meeting between USEPA, TRC, Chevron
March 24, 2017	NJDEP letter regarding the November 2016 SEER

November 1, 2016	Supplemental Ecological Evaluation Completed and Report (SEER) submitted to the USEPA and NJDEP.
November 1, 2003	Baseline Ecological Evaluation/2003 RCRA Facilities Investigation (BEE/RFI) completed and RFI Report submitted to the USEPA.

A summary of each of the prior water body investigations are provided further in this report. Details of the prior 2002 and 2014 investigations are provided in Appendices A and B, respectively, with the complete 2019 investigation details are provided in Appendix C (the SSI report).

The initial phase of sediment investigation occurred as part of the RFI in 2002, and the investigation activities and results were included in the 2003 RFI report. The sediment investigation activities in 2002 and subsequent investigations were conducted pursuant to the Hazardous and Solid Waste Amendments (HSWA) Permit Renewal and Permit Modification I issued by the USEPA in 2013 to Chevron USA, Inc.–Buckeye Perth Amboy Terminal LLC (EPA I.D. # NJD081982902).

In 2014, the Supplemental Ecological Evaluation (SEE) was conducted to close data gaps identified through discussion with the USEPA/NJDEP and particularly focused on sampling and analyzing sediments for Extractable Petroleum Hydrocarbons (EPH). The 2014 investigation activities and results were described in the 2016 SEER.

The investigations in 2003 and 2014 were conducted pursuant to the HSWA Permit Renewal and Permit Modification I issued by the USEPA in 2013 to Chevron USA, Inc.–Buckeye Perth Amboy Terminal LLC (EPA I.D. # NJD081982902). The 2013 HSWA Permit required that the RFI be completed for reaches of the Arthur Kill, Woodbridge Creek and Spa Spring Creek adjacent to the Facility. Chevron completed an additional sediment investigation in 2014 to address the HSWA Permit requirements as documented in the SEER submitted in November 2016. The USEPA/NJDEP required that Chevron further investigate water body sediments following their review of the SEER. Chevron prepared the November 2018 and July 2019 editions of the SFSAP to address the agencies' comments on the SEER and their subsequent comments contained in the various correspondence noted above. The data tables, sediment core logs and Figures 3-6 of the SEER are included in Appendix B.

The Baseline Ecological Evaluation (BEE) completed as part of the 2002 RFI included surface water and sediment sampling completed in December 2002, and related laboratory analysis. The BEE activities were described in Section 9 of the 2003 RFI report (Appendix A). As stated in the RFI report, the BEE was performed to address the surface water and sediment investigation provisions of the RCRA Corrective Action Permit Scope of Work for the RFI. The RFI requirements were subsequently assumed under the 2013 HSWA permit. Beyond the RCRA-related requirements, the overall investigation of the Facility with respect to compliance with the NJDEP's Site Remediation Program (SRP) began in 2012 when Chevron sold most of the Facility to Buckeye.

As noted in their correspondence with Chevron, and as discussed during the August 7, 2019 meeting, areas of potential historic contamination associated with particular areas proximal to the water bodies and historic discharges were of primary concern to the USEPA/NJDEP. These areas included SWMUs, AOCs, and LNAPL areas (Figure 2A). Consequently, the SFSAP was revised in July 2019 to include both background information and historical data collected from soil borings and groundwater monitoring wells in and near these areas, which are generally within 200 feet of the water bodies. These areas are the closest potential contaminant sources to Facility adjacent water bodies, and the SFSAP was revised in part to further assess these areas. The 2019 sediment sampling was completed as proposed in the approved SFSAP as described in the 2019 SSI (Appendix C) and supplements the existing data set. The expanded areal coverage and expanded analytical suite sufficiently characterizes sediment conditions near the historic discharge areas, e.g., SWMU 40 and other areas proximal to Woodbridge Creek (Appendix C Figure C-1). The findings of the FSSIR confirm those of the prior investigations regarding the nature and extent of contaminated water body sediments, including areas proximal to historic discharge points, i.e., that:

1) Recently deposited soft sediments are present in Spa Spring Creek, Woodbridge Creek, and background areas and contain a similar suite of constituents (VOCs [generally limited to the BTEX constituents], SVOCs [including the PAHs], and several metals) above the NJDEP's Ecological Screening Criteria;
2) The downstream physical extent of contaminated soft sediments in Woodbridge Creek has been determined by the bathymetric survey (2014 SEE);
3) The lateral extent of soft sediments is limited by each bank of Spa Spring Creek and Woodbridge Creek; and,
4) The vertical extent of soft sediments is defined by the top of the underlying dense, regional glacial till and clay below the creek beds (generally determined by refusal of drilling equipment).

Based on the collective findings of the three investigations, Chevron believes the objective of the HSWA permit requirements for water body investigations is complete.

4.0 TECHNICAL OVERVIEW

This section provides a technical overview of the sediment investigation activities conducted in 2002, 2014 and 2019. The 2002 sediment investigation was conducted as part of the RFI completed in accordance with the *RCRA Facilities Investigation Workplan* (October 2001, amended September 2002), and the NJDEP's Technical Requirements for Site Remediation (TRSR) and sediment evaluation guidance. The 2002 sediment samples obtained from Woodbridge Creek and Spa Spring Creek were collected along transects that cross the water body, oriented perpendicular to flow direction at most locations. Supplemental Ecological Evaluation (SEE) was completed in accordance with the NJDEP's Ecological Evaluation Technical Guidance (EETG) and revised TRSR, which superseded the NJDEP's previous BEE requirements. The SEE was also implemented to address the USEPA and NJDEP comments provided in their 2004 and 2009 letters, and incorporated Chevron's responses provided in the 2008 Supplemental RFI and October 2010 response letter (Attachment 2). The 2019 sediment investigation was conducted in accordance with the approved SFSAP. This FSSIR provides an evaluation of the combined sediment analytical data generated from the 2002, 2014 and 2019 investigations. The data collected during the 2002 and 2014 investigations were previously submitted to the USEPA and NJDEP with previous reports as noted above. The data from the 2019 sampling event along with sample collection details, sediment core logs, cross sections and bathymetric profiles are included, along with laboratory sample analytical reports and electronic data submissions (EDS) in the *2019 Supplemental Sediment Investigation Report* attached as Appendix C.

As noted in Chevron's July 2, 2019 RTC letter, soil and groundwater laboratory analytical data for areas of the Facility located within 200 feet of the Facility-adjacent water bodies are provided in Appendix E.

4.1 Sediment and Surface Water Quality

Spa Spring Creek, Woodbridge Creek, and the portion of the Arthur Kill adjacent to former Facility operational areas are the nearest ecological receptors potentially affected by historical discharges. Chemical constituents detected in the sediments of these water bodies were identified as Contaminants of Potential Ecological Concern (COPECs) based on comparison of the analytical results to the NJDEP's Ecological Screening Criteria (ESCs).

For the FSSIR, the term "sediment" refers to the unconsolidated material deposited by water on the bottom of the subject water bodies, consistent with the NJDEP's definition in the EETG. As noted in Chevron's July 2, 2019 RTC (as approved as part of the revised SFSAP), the sediment that is the subject of the FSSIR is the soft material deposited above and not including the underlying glacial till and dense clay, silty-clays, and other materials associated with the regional geologic formations. This is practically implemented based on the depth to refusal at sample core locations. The extent and nature of the soft sediment was established by the 2002 and 2014 investigations and confirmed by the 2019 SSI.

As noted in the 2003 RFI report and the approved SFSAP, the evaluation of surface water quality was completed as part of the 2002 RFI, and it was determined that no further evaluation of surface water was required. The absence of COPECs in surface water, with the exception of very limited detections of metal constituents, supported this determination. Therefore, subsequent evaluation of surface water quality was limited to measuring pH, dissolved oxygen (DO), temperature, salinity, conductivity, and turbidity with a field water quality meter.

4.2 Sediment Investigation Objectives

The overall objective of the sediment investigation is to complete the characterization and delineation of COPECs in sediment associated with the Facility-adjacent water bodies, and to provide the data necessary to meet the requirements of Chevron's HSWA permit. While each of the three investigative phases were completed to meet specific objectives, e.g., addressing the requirements for the RFI, addressing data gaps, and responding to agency review comments, the overall objective is to meet the HSWA permit requirements.

4.3 Remediation Standards and Criteria

Remediation standards and criteria that were used for evaluation of surface water and sediment data include the NJDEP's Surface Water Quality Standards (SWQS) acute and chronic aquatic life protection criteria (NJAC 7:9b), and the Ecological Screening Criteria (ESC [March 2009]), including the Effects Range-Low (ER-L) and Effects Range-Moderate (ER-M) criteria for sediment in saline water bodies (collectively "ESC"). The NJDEP's method for analyzing EPH was published in 2009 and was not available for the 2002 RFI. However, EPH was included as a sediment sample analytical parameter in the 2014 and 2019 sampling events. The NJDEP's EETG indicates that no standard or criterion exists for EPH in sediment. Therefore, the evaluation of EPH data is limited to comparison of relative concentrations among sample locations and background. However, summary statistics are provided for EPH along with COPEC to facilitate data evaluation.

Summary statistics for COPECs are provided for all existing and recent data and were compared to the current ESC (Section 5). The respective numerical ESC and the laboratory sample results for all analytical parameters for samples collected during the 2002, 2014 and 2019 sampling events are listed in the results tables referenced and attached herein (see Appendices A-C). In accordance with the EETG, contaminants with concentrations above their respective SWQS or ESC are identified as COPECs. Consistent with procedures accepted by the NJDEP at other sites, constituents detected above laboratory method detection limits in more than 10% of the sediment samples were retained as COPECs for this evaluation, regardless of concentration relative to an ESC (see Section 5). Major earth elements such as aluminum, iron, magnesium, manganese, potassium, and sodium are generally not considered COPECs and were not retained for further evaluation in the sediment data statistical summaries.

As noted in the July 2019 SFSAP, upper confidence limits of the mean were calculated using the combined data from the background samples collected in Spa Spring Creek and Woodbridge Creek. The 95% upper confidence limit (95UCL) mean concentrations for each COPEC detected in the background sediment samples were calculated using (ProUCL, version 5.1; USEPA, 2015). The ProUCL input data and output 95UCL results for each COPEC are included in Attachment 3. The 95UCLs are also included in summary statistics lists, below in Section 5.4.

4.4 Data Reliability

Sediment and surface water laboratory analytical data previously submitted to the USEPA and NJDEP with the 2003 RFI Report and 2016 SEER were generated by Eurofins (formerly Lancaster Laboratories) and SGS (formerly Accutest Laboratories), both New Jersey-certified laboratories, and were previously evaluated for reliability, and were accepted by the USEPA and NJDEP. Therefore, they are accepted as reliable without further review.

Sediment and surface water samples collected in 2019 in accordance with the SFSAP. No significant events or seasonal variations are known to have influenced the sampling procedures as described in the SFSAP or the analytical results reported by the laboratory.

Sediment samples collected during the 2019 sampling event were analyzed by Eurofins Laboratories of Lancaster, PA - a New Jersey-certified laboratory. Analysis of surface water field parameters during the 2019 sampling event, including pH, temperature, conductivity, turbidity, salinity and DO, was performed by TRC, a New Jersey-certified laboratory.

A quality assurance review was performed for the laboratory analytical reports for the samples analyzed in the SSI in accordance with the NJDEPs *Quality Assurance Project Plan Technical Guidance* (QAPP Guidance, April 2014), and the NJDEP's *Data of Known Quality Protocols* [DKQP], April 2014). The method-specified calibrations and quality control performance criteria were met for the data generated during this investigation, with few exceptions, as indicated in the conformance/non-conformance summaries provided in the laboratory reports. Electronic copies of the SSI laboratory reports are included in Attachment 1.

Based on a quality assurance review of the sample analytical laboratory reports, the sediment sample data for the 2019 sample event meet the DKQP and TRC did not reject any data points. Therefore, laboratory sample analytical data are valid and useful for the project data quality objectives and their intended purpose.

4.5 Field Sampling Methods and Laboratory Analysis

Sample collection activities and laboratory analyses of sediment samples were performed in accordance with the TRSR, the SFSAP, and the project QAPP. Laboratory sample analyses for the 2019 sampling event were completed by Eurofins/Lancaster Laboratories of Lancaster, Pennsylvania, and by SGS Laboratories of Dayton, New Jersey for the 2003 and 2014 sampling events; both Eurofins and SGS are New Jersey-certified laboratories. Field surface water quality monitoring parameters were measured and analyzed by TRC, a New Jersey-certified laboratory. In general, sediment sampling proceeded in the opposite direction of water flow, which varied based on tidal conditions.

4.5.1 Water Quality Measurements

Surface water quality parameters including pH, temperature, conductivity, turbidity, salinity, and DO were measured in 2019 using a YSI 6000 series field meter with a Sonde attached on a data cable. Measurements were made at the mid-point of the water column. Measurements of water quality parameters were obtained for each day of sediment sampling, and prior to the collection of sediment samples for each sediment sampling transect.

4.5.2 *Sediment Sampling*

Sediment cores were collected using one of the following methods:

- Vibracore drilling equipment and core barrels mechanically driven from vessels operated by EEA, Inc. of Garden City, New York (2002 RFI sampling event) and AquaSurvey, Inc. of Flemington, New Jersey (2014 and 2019 investigations).

- Ponar dredge lowered from a vessel (2019) or bridge (2002) for collection of samples in upper 0.5-foot sediment interval.

- Manually advancing stainless-steel hand augers or core barrels in narrow, shallow reaches of Spa Spring Creek (2014, 2019).

Sediment cores were field-screened with a calibrated multi-gas (photo-ionization detector [PID]) meter, and visually characterized and logged using the Burmister soil classification system. Samples for laboratory analysis were collected from either pre-determined intervals or based on field observations/screening as described in the SFSAP. Details concerning the specific activities associated with sample collection are provided in the reports associated with each investigative phase.

4.5.3 *Sediment Sample Analysis*

Sediment samples were analyzed for a variety of parameters over the course of the investigation, due to the changes in analytical methods, regulations, and objectives of the particular investigative phase. The sediment samples were analyzed as follows:

<u>2002 RFI (baseline sampling event):</u>

- USEPA Target Analyte List (TAL) Metals
- USEPA Target Compound List (TCL) Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs)
- General Chemistry: TOC, Total Kjeldahl nitrogen (TKN), pH
- Grain size determination (ASTM-D methods)

<u>2014 SEE (analysis focused on specific sample locations and depths)</u>

- Extractable Petroleum Hydrocarbons (EPH) – samples collected at transects SED-02, SED-03, SED-04, SED-06, and SED-09
- USEPA TAL/TCL with a 30 peak library search (TAL/TCL+30) – limited to six samples at transects SED-19, SED-20 and SED-21
- Grain Size Analysis (ASTM-D methods)
- General Chemistry: TOC (Lloyd Khan), pH

<u>2019 SSI (sample locations and analysis focused on data gaps and establishing background datasets)</u>

- EPH
- TAL metals
- TCL VOCs and SVOCs
- Grain Size Analysis (ASTM-D methods)
- General Chemistry: TOC (Lloyd Khan), pH

A summary of the samples and analytical parameters collected and analyzed during the 2002, 2014 and 2019 water body sediment investigation events is provided in Table 1. The laboratory sediment sample analytical results from the combined 2002, 2014 and 2019 sediment sampling events are presented on Figures 3 through 11. Tabulated analytical results for the samples collected in 2019 are included in Appendix C (Tables C-II through C-XXII). The analytical results tables from the 2002 and 2014 sampling events are included in Appendices A and B, respectively.

5.0 Summary of 2002, 2014 and 2019 Water Body Investigations

The three phases of investigation completed for water bodies near the Facility in 2002, 2014 and 2019 are summarized below. Separate summaries are provided for each phase followed by an evaluation of the combined investigation data from all three investigation phases. The summaries describe the key activities and findings for each of the investigative phases and provide an evaluation of the sediment analytical results compared to the ESC. As noted above, EPH, which was not among the analyses in the 2002 RFI, was included and evaluated in the 2014 and 2019 sampling events.

Laboratory sample analytical results for the sediment samples collected in 2002 and 2014, and in 2019 are included separately on tables and figures included in Appendices A, B, and C, respectively. The analytical results combined for all COPECs detected in sediment samples collected from Spa Spring Creek and Woodbridge Creek in 2002, 2014, and 2019 are presented on Figures 3 through 11.

As part of the 2019 investigation, the number of background sediment samples in Spa Spring Creek and Woodbridge Creek was expanded to allow a more robust evaluation of analytical results for areas well upstream of the Facility. Background sediment samples were collected from two depth intervals at four locations in Spa Spring Creek during both the 2014 and 2019 sampling events (total of 16 background sediment samples). Background samples were collected from multiple depth intervals at 11 locations in Woodbridge Creek in the vicinity of Transect SED-10 (total of 39 background sediment samples). Background sample locations in each water body are shown on Figure 2. Analytical results for background sediment samples are presented on Figures 4 and 11. Laboratory analytical data for background sediment samples collected during the 2002 and 2014 sampling events are included in Appendices A and B, respectively. Laboratory analytical data for background sediment samples collected during the 2019 sampling event are included in Appendix C. Appendix C also includes data for background sediment sample data for physical and miscellaneous parameters. In general, petroleum related constituents were detected at elevated levels in sediments adjacent to the facility, as well as similar constituents and other non-petroleum-related constituents in sediments adjacent to the Facility and in other areas.

5.1 Summary of 2002 Water Bodies Investigation

Chevron performed a surface water and sediment investigation in 2002 that included both sediment and surface water sampling and analysis as part of the RFI. The results of the investigation were provided to the NJDEP and USEPA in the BEE that was included as Section 9 of Chevron's November 2003 RFI Report and the February 2008 Supplemental RFI Report (SRFI Report). Surface water and sediment samples were collected from boats or from the shore as needed.

The BEE noted that the physical conditions along Woodbridge and Spa Spring Creeks varied, but generally consisted of fill materials, with or without associated littoral vegetation, and with occasional cultural debris along the wrack line (wood, tires, trash). The creek banks in other areas were typically modified with wooden or steel bulkheads or rip-rap stone, as is the case today. No sheen or other visual indicators of contamination or effects on biota were observed in surface waters or along the banks of the creeks. Chemical data for soils, groundwater, sediment, and surface water were evaluated to characterize and document the water and sediment quality in the water bodies near the Facility.

5.1.1 Surface Water

In 2002, Chevron collected 16 surface water samples from the waters of Spa Spring Creek, Woodbridge Creek, and the Arthur Kill which were analyzed for organic and inorganic chemical constituents including VOCs, SVOCs (i.e., base neutral compounds [BNs]), and metals.

As reported in the 2002 BEE, the surface water analytical results were compared to the NJDEP SWQS and ESCs and indicated limited detections of nickel, mercury (unfiltered), and zinc at low concentrations. The analytical results for the 2002 surface water samples are included on Tables 9-12 to 9-15 of Appendix A. The 2003 RFI Report did not recommend further evaluation of surface waters due to the limited detection of COPECs in surface waters. In addition, additional surface water investigation was not proposed in the approved 2019 SFSAP. Therefore, no further evaluation of surface water was warranted or proposed.

5.1.2 Sediment

Chevron collected sediment samples at two depths at 36 locations Spa Spring Creek, Woodbridge Creek and Arthur Kill, in 2002 which were also analyzed for organic and inorganic chemical constituents including VOCs, SVOCs/BNs, and metals.

The sediment sampling and analysis conducted in 2002 identified various organic compounds (primarily BNs) and metals in multiple sediment samples, with fewer occurrences of VOCs (e.g., benzene) in sediment samples at concentrations above the ESCs. Petroleum staining had been observed in some sediment sample cores, including several collected to characterize conditions at locations upstream of the Facility. Summary statistics for the 2002 sediment sample analytical data at the Facility compared to the NJDEP's ER-L and ER-M ESCs are provided below for each of the three water bodies, Spa Spring Creek, Woodbridge Creek, and the Arthur Kill. Note that three background sediment samples for Woodbridge Creek were collected in 2002 from transect SED-10 located just downstream of the Woodbridge Avenue bridge (Figure 2).

<u>Spa Spring Creek</u>
Summary statistics for the COPECs in Spa Spring Creek sediment samples collected in 2002 are as follows:

	Standards/Criteria		Site Data Summary				Frequency			
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	6	0	0.017	0.0055	3	50%	1	0
Acenaphthylene	0.044	0.64	6	0	0.083	0.016	2	33%	1	0
Anthracene	0.085	1.1	6	0	0.13	0.03	3	50%	1	0
Arsenic	8.2	70	6	6.2	164	35.1	6	100%	5	1
Barium	--	48	6	43.4	165	78.0	6	100%	NA	5
Benzo(a)pyrene	0.43	1.6	6	0	0.45	0.118	5	83%	1	0
Benzo(a)anthracene	0.261	1.6	6	0	0.29	0.08	4	67%	1	0

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Benzo(ghi)perylene	0.17	--	6	0	0.74	0.1685	4	67%	2	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	6	0	0.86	0.227	2	33%	2	0
Cadmium	1.2	9.6	6	0	2.5	1.21	5	83%	3	0
Chromium	81	370	6	15	133	44.6	6	100%	1	0
Chrysene	0.384	2.8	6	0.011	0.39	0.119	6	100%	1	0
Cobalt	--	10	6	5.1	36.7	17.9	6	100%	NA	5
Copper	34	270	6	8.2	494	109	6	100%	2	1
Dibenz(a,h)anthracene	0.063	0.26	6	0	0.15	0.034	3	50%	1	0
Fluorene	0.019	0.54	6	0	0.031	0.01	4	67%	1	0
Indeno(1,2,3-cd)pyrene	0.2	--	6	0	0.37	0.098	5	83%	1	NA
Lead	47	218	6	7.7	656	126	6	100%	1	1
Mercury	0.15	0.71	6	0	2.6	0.433	1	17%	1	1
Nickel	21	52	6	17	85.1	46.1	6	100%	5	2
Phenanthrene	0.24	1.5	6	0.011	0.31	0.094	6	100%	1	0
Selenium	--	1	6	0	13	2.17	1	17%	NA	1
Silver	1	3.7	6	0	2.1	0.35	1	17%	1	0
Total PAHs	4	45	6	0.1055	4.891	1.37	6	100%	1	0
Vanadium	--	57	6	30	109	54.4	6	100%	NA	1
Zinc	150	410	6	58.4	1140	349	6	100%	2	2

Several of the PAHs and metals were detected above the ER-L in Spa Spring Creek sediments. However, concentrations are generally low relative to ESCs for many of the COPECs. Specific PAHs including benzo(a)pyrene (BaP), benzo(a)anthracene (BaA), and bis(2-ethylhexyl)phthalate were among the PAHs detected above the ER-L. The maximum total PAH concentration was 4.89 mg/kg. Metal COPECs were also detected above both the ER-L and ER-M, with barium, cobalt, lead, mercury, nickel, selenium, and zinc exceeding the ER-M. Lead was detected in each of the samples ranging from 7.7 mg/kg to 656 mg/kg, with a mean of 126 mg/kg. No VOCs were detected above their respective ESC.

Background sediment samples were not collected for Spa Spring Creek in 2002.

<u>Woodbridge Creek/</u>

Summary statistics for the COPECs in Woodbridge Creek sediment background samples collected in 2002 are as follows:

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	3	0.0008	0.052	0.023	3	100%	2	0

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Anthracene	0.085	1.1	3	0.017	0.19	0.086	3	100%	1	0
Benzo(a)pyrene	0.43	1.6	3	0.19	0.65	0.353	3	100%	1	0
Benzo(a)anthracene	0.261	1.6	3	0.14	0.63	0.327	3	100%	1	0
Benzo(ghi)perylene	0.17	--	3	0.095	0.21	0.158	3	100%	1	NA
Benzo(k)fluoranthene	0.24	--	3	0.087	0.34	0.176	3	100%	1	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	3	0.46	5.2	2.22	3	100%	3	1
Chrysene	0.384	2.8	3	0.14	1	0.46	3	100%	1	0
Copper	34	270	3	47.3	85.7	67.5	3	100%	3	0
Dibenz(a,h)anthracene	0.063	0.26	3	0.026	0.073	0.045	3	100%	1	0
Fluoranthene	0.6	5.1	3	0.12	1.1	0.54	3	100%	1	0
Fluorene	0.019	0.54	3	0.0012	0.074	0.0314	3	100%	1	0
Indeno(1,2,3-cd)pyrene	0.2	--	3	0.095	0.22	0.152	3	100%	1	NA
Lead	47	218	3	35	110	65.8	3	100%	2	0
2-Methylnaphthalene	0.07	0.67	3	0.00086	0.22	0.075	3	100%	1	0
Naphthalene	0.16	2.1	3	0.0018	0.22	0.075	3	100%	1	0
Nickel	21	52	3	28.8	33.7	31.2	3	100%	3	0
Phenanthrene	0.24	1.5	3	0.011	0.77	0.34	3	100%	1	0
Pyrene	0.665	2.6	3	0.24	1.4	0.703	3	100%	1	0
Total PAHs	4	45	3	1.39666	8.276	4.11	3	100%	1	0
Vanadium	--	57	3	13.7	75.2	35.3	3	100%	NA	1
Zinc	150	410	3	184	457	363	3	100%	3	2

The COPECs detected in the background samples collected in Woodbridge Creek are similar to those detected in the downstream samples, though typically at concentrations one or more orders of magnitude lower, and with fewer metal COPECs. However, only three background sediment samples were collected in 2002, with additional background samples collected in 2019 as discussed later in the FSSIR.

Summary statistics for the COPECs in Woodbridge Creek sediment sample data collected in 2002 are as follows:

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	26	0	2.8	0.363	24	92%	21	4
Acenaphthylene	0.044	0.64	26	0.001	1.2	0.194	26	100%	21	3
Anthracene	0.085	1.1	26	0.003	3.1	0.554	26	100%	22	4
Arsenic	8.2	70	26	5.8	91.7	28.5	26	100%	23	1
Barium	--	48	26	17.1	272	90.7	26	100%	NA	18

COPEC (mg/kg)	Standards/Criteria		Site Data Summary					Frequency		
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Benzene	0.34	--	26	0	20	1.59	4	15%	4	NA
Benzo(a)pyrene	0.43	1.6	26	0.01	13	1.74	26	100%	19	6
Benzo(a)anthracene	0.261	1.6	26	0.008	6.5	1.22	26	100%	22	6
Benzo(b)fluoranthene	--	1.8	25	0.017	9.6	1.75	25	100%	NA	6
Benzo(ghi)perylene	0.17	--	26	0.011	18	2.00	26	100%	23	NA
Benzo(k)fluoranthene	0.24	--	26	0.006	1.3	0.465	26	100%	17	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	26	0	50	7.12	24	92%	22	12
Cadmium	1.2	9.6	26	0.68	13	3.77	26	100%	18	3
Chromium	81	370	26	20.5	166	67.0	26	100%	8	0
Chrysene	0.384	2.8	26	0.011	11	1.87	26	100%	21	3
Cobalt	--	10	26	5.9	85.9	16.8	26	100%	NA	16
Copper	34	270	26	17.7	8030	755	26	100%	25	18
Dibenz(a,h)anthracene	0.063	0.26	26	0.002	4	0.454	26	100%	21	9
Ethylbenzene	1.4	--	26	0	6.6	0.658	4	15%	3	NA
Fluoranthene	0.6	5.1	26	0.021	5.5	1.81	26	100%	22	1
Fluorene	0.019	0.54	26	0	5.8	0.663	25	96%	21	5
Indeno(1,2,3-cd)pyrene	0.2	--	26	0.008	4.1	0.824	26	100%	19	NA
Lead	47	218	26	13.5	399	174	26	100%	24	9
Mercury	0.15	0.71	26	0.03	5.8	1.51	26	100%	22	13
2-Methylnaphthalene	0.07	0.67	26	0	39	3.03	25	96%	8	5
Naphthalene	0.16	2.1	26	0	10	0.933	22	85%	6	4
Nickel	21	52	26	28.6	2480	190	26	100%	26	17
Phenanthrene	0.24	1.5	26	0.011	18	2.44	26	100%	18	9
Pyrene	0.665	2.6	26	0.027	13	3.15	26	100%	23	10
Selenium	--	1	26	0	154	18.4	25	96%	NA	25
Silver	1	3.7	26	0	5.4	1.85	24	92%	14	6
Toluene	2.5	--	26	0	2.9	0.189	3	12%	1	NA
Total PAHs	4	45	26	0.147	140.6	23.4	26	100%	22	3
Vanadium	--	57	26	22.6	100	51.7	26	100%	NA	10
Zinc	150	410	26	88.9	2970	470	26	100%	23	11
Xylenes (total)	0.12	--	26	0	29	3.41	5	19%	5	NA

The 2002 summary statistics for Woodbridge Creek indicate a similar suite of COPECs to those detected in 2002 Spa Spring Creek sediment samples, i.e., PAHs and metals. Several of the PAHs including BaA, BaP, BbF, and benzo(ghi)perylene (BghiP) were detected above both the ER-L and ER-M, generally one order of magnitude higher than their concentrations in Spa Spring Creek (see below). The metals detected in the Woodbridge Creek sediments were generally detected above both the ER-L and ER-M, except for chromium. Lead was detected at concentrations ranging from 13.5 mg/kg to 399 mg/kg, with a mean of 174 mg/kg, which is below its concentration range in Spa Spring Creek (see below).

Arthur Kill

Summary statistics for the COPECs in Arthur Kill background (upstream, downstream) sediment samples collected in 2002 are as follows:

	Standards/Criteria		Site Data Summary				Frequency		
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	2	0.027	3.9	1.9635	2	2	1
Acenaphthylene	0.044	0.64	2	0.15	0.59	0.37	2	2	0
Anthracene	0.085	1.1	2	0.25	2.4	1.325	2	2	1
Arsenic	8.2	70	2	46.7	107	76.85	2	2	1
Barium	--	48	2	202	245	223.5	2	NA	2
Benzo(a)pyrene	0.43	1.6	2	0.65	3.2	1.925	2	2	1
Benzo(a)anthracene	0.261	1.6	2	0.44	3.7	2.07	2	2	1
Benzo(b)fluoranthene	--	1.8	2	0.9	3.7	2.3	2	NA	1
Benzo(ghi)perylene	0.17	--	2	0.33	1.7	1.015	2	2	NA
Benzo(k)fluoranthene	0.24	--	2	0.33	1.2	0.765	2	2	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	2	0	21	10.5	1	1	1
Cadmium	1.2	9.6	2	2.3	5.9	4.1	2	2	0
Chromium	81	370	2	140	198	169	2	2	0
Chrysene	0.384	2.8	2	0.7	3.8	2.25	2	2	1
Cobalt	--	10	2	14.3	15.4	14.85	2	NA	2
Copper	34	270	2	413	587	500	2	2	2
Dibenz(a,h)anthracene	0.063	0.26	2	0.094	0.47	0.282	2	2	1
Fluoranthene	0.6	5.1	2	1	6.4	3.7	2	2	1
Fluorene	0.019	0.54	2	0.05	1.2	0.625	2	2	1
Indeno(1,2,3-cd)pyrene	0.2	--	2	0.36	1.6	0.98	2	2	NA
Lead	47	218	2	291	322	306.5	2	2	2
Mercury	0.15	0.71	2	2.6	7	4.8	2	2	2
2-Methylnaphthalene	0.07	0.67	2	0.065	0.67	0.3675	2	1	0
Naphthalene	0.16	2.1	2	0.11	0.8	0.455	2	1	0
Nickel	21	52	2	59.7	64.3	62	2	2	2
Phenanthrene	0.24	1.5	2	0.2	2.2	1.2	2	1	1
Pyrene	0.665	2.6	2	1.3	7.3	4.3	2	2	1
Selenium	--	1	2	2.8	8	5.4	2	NA	2
Silver	1	3.7	2	2.4	7.9	5.15	2	2	1
Total PAHs	4	45	2	6.956	44.83	25.893	2	2	0
Vanadium	--	57	2	58.7	80.9	69.8	2	NA	2
Zinc	150	410	2	405	617	511	2	2	1

Based on the summary statistics presented above, COPECs identified in the Arthur Kill background sediment samples include several metals and PAHs.

Summary statistics for the COPECs in Arthur Kill sediment samples collected in 2002 are as follows:

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency		
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	5	0.04	0.46	0.142	5	5	0
Acenaphthylene	0.044	0.64	5	0.12	0.15	0.14	5	5	0
Anthracene	0.085	1.1	5	0.26	0.31	0.286	5	5	0
Arsenic	8.2	70	5	28.3	35.8	30.32	5	5	0
Barium	--	48	5	136	192	152.8	5	NA	5
Benzo(a)pyrene	0.43	1.6	5	0.6	0.85	0.674	5	5	0
Benzo(a)anthracene	0.261	1.6	5	0.52	0.65	0.572	5	5	0
Benzo(ghi)perylene	0.17	--	5	0.26	0.63	0.386	5	5	NA
Benzo(k)fluoranthene	0.24	--	5	0.26	0.44	0.348	5	5	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	5	3.7	4.8	4.32	5	5	5
Cadmium	1.2	9.6	5	2.2	2.6	2.38	5	5	0
Chromium	81	370	5	116	134	121.4	5	5	0
Chrysene	0.384	2.8	5	0.59	0.94	0.7	5	5	0
Cobalt	--	10	5	13.7	15.5	14.5	5	NA	5
Copper	34	270	5	257	302	272	5	5	2
Dibenz(a,h)anthracene	0.063	0.26	5	0.084	0.15	0.105	5	5	0
Fluoranthene	0.6	5.1	5	0.92	1.3	1.124	5	5	0
Fluorene	0.019	0.54	5	0.053	0.21	0.099	5	5	0
Indeno(1,2,3-cd)pyrene	0.2	--	5	0.3	0.64	0.404	5	5	NA
Lead	47	218	5	194	230	206	5	5	1
Mercury	0.15	0.71	5	2.4	3.2	2.64	5	5	5
2-Methylnaphthalene	0.07	0.67	5	0.064	0.085	0.071	5	1	0
Nickel	21	52	5	45.1	52.3	47.76	5	5	1
Phenanthrene	0.24	1.5	5	0.28	0.36	0.316	5	5	0
Pyrene	0.665	2.6	5	1.2	1.6	1.36	5	5	0
Selenium	--	1	5	0	3.4	1.36	3	NA	3
Silver	1	3.7	5	4.2	5.2	4.54	5	5	5
Total PAHs	4	45	5	6.131	9.167	7.689	5	5	0
Vanadium	--	57	5	65.7	77.4	69.52	5	NA	5
Zinc	150	410	5	361	393	377.4	5	5	0

The COPECs identified in the Arthur Kill sediments are similar to those detected in Woodbridge Creek and Spa Spring Creek, i.e., PAHs and metals. However, no VOC COPECs were detected in Arthur Kill sediment samples.

Summary statistics for the COPECs in the Arthur Kill background (upstream, downstream) sediment samples collected in 2002 are as follows:

	Standards/Criteria		Site Data Summary				Frequency		
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	2	0.027	3.9	1.9635	2	2	1
Acenaphthylene	0.044	0.64	2	0.15	0.59	0.37	2	2	0
Anthracene	0.085	1.1	2	0.25	2.4	1.325	2	2	1
Arsenic	8.2	70	2	46.7	107	76.85	2	2	1
Barium	--	48	2	202	245	223.5	2	NA	2
Benzo(a)pyrene	0.43	1.6	2	0.65	3.2	1.925	2	2	1
Benzo(a)anthracene	0.261	1.6	2	0.44	3.7	2.07	2	2	1
Benzo(b)fluoranthene	--	1.8	2	0.9	3.7	2.3	2	NA	1
Benzo(ghi)perylene	0.17	--	2	0.33	1.7	1.015	2	2	NA
Benzo(k)fluoranthene	0.24	--	2	0.33	1.2	0.765	2	2	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	2	0	21	10.5	1	1	1
Cadmium	1.2	9.6	2	2.3	5.9	4.1	2	2	0
Chromium	81	370	2	140	198	169	2	2	0
Chrysene	0.384	2.8	2	0.7	3.8	2.25	2	2	1
Cobalt	--	10	2	14.3	15.4	14.85	2	NA	2
Copper	34	270	2	413	587	500	2	2	2
Dibenz(a,h)anthracene	0.063	0.26	2	0.094	0.47	0.282	2	2	1
Fluoranthene	0.6	5.1	2	1	6.4	3.7	2	2	1
Fluorene	0.019	0.54	2	0.05	1.2	0.625	2	2	1
Indeno(1,2,3-cd)pyrene	0.2	--	2	0.36	1.6	0.98	2	2	NA
Lead	47	218	2	291	322	306.5	2	2	2
Mercury	0.15	0.71	2	2.6	7	4.8	2	2	2
2-Methylnaphthalene	0.07	0.67	2	0.065	0.67	0.3675	2	1	0
Naphthalene	0.16	2.1	2	0.11	0.8	0.455	2	1	0
Nickel	21	52	2	59.7	64.3	62	2	2	2
Phenanthrene	0.24	1.5	2	0.2	2.2	1.2	2	1	1
Pyrene	0.665	2.6	2	1.3	7.3	4.3	2	2	1
Selenium	--	1	2	2.8	8	5.4	2	NA	2
Silver	1	3.7	2	2.4	7.9	5.15	2	2	1
Total PAHs	4	45	2	6.956	44.83	25.893	2	2	0
Vanadium	--	57	2	58.7	80.9	69.8	2	NA	2
Zinc	150	410	2	405	617	511	2	2	1

In general, the concentrations of COPECs detected in the upstream and downstream background samples exceed those detected in Arthur Kill sediment samples located adjacent to the Facility, which highlights the regional nature of these constituents. Given that the background samples in the Arthur Kill generally contained COPECs above those collected closer to the Facility, and the periodic dredging of these areas and the channel of the Arthur Kill, no further sampling was proposed for the Arthur Kill, consistent with the prior reports and the approved SFSAP. Locations and laboratory analytical results for sediment samples collected in the Arthur Kill are included in Appendix A.

5.2 Summary of 2014 Supplemental Sediment Investigation

In response to NJDEP and USEPA comments on the 2003 BEE 2014, a second phase of sediment investigation was implemented to supplement prior investigation data, including collection of sediment samples from four background locations in Spa Spring Creek and 10 locations in Woodbridge Creek. The results of this supplemental investigation were provided in the 2016 SEER; analytical results tables, Figures 3-6 and sediment core logs from the 2014 SEER are included in Appendix B. It should be noted that the SEER Figure 4 included in Appendix B was revised as noted in the August 2019 RTCs to address typographical errors in data boxes.

As part of the 2014 supplemental investigation, Chevron re-evaluated COPECs, and analyzed sediment samples collected in Spa Spring Creek and Woodbridge Creek for EPH. The NJDEP's EPH analytical method was not available in 2002 but was analyzed in sediment samples collected in 2014. Further evaluation of potential contaminant migration pathways to surface water was also completed. Samples collected for analysis of EPH were also subject to physical testing (grain size determination), and analysis of TOC and pH. Background samples in Spa Spring Creek at transects SED-20 and SED-21 and samples in Woodbridge Creek at transect SED-19 were also collected and analyzed for the USEPA's TAL/TCL parameters, EPH, grain size, TOC, and pH. Existing data from the Arthur Kill sediment samples was re-evaluated by comparing the upstream and downstream background sample data to data obtained from Facility-adjacent sediment samples. The existing surface water data for Spa Spring Creek and Woodbridge Creek was also re-evaluated. Data from sediment and surface water samples was compared to existing data from adjacent soil and groundwater sample data to evaluate potential data gaps with respect to COPEC identification.

As part of the 2014 supplemental investigation, a bathymetric survey providing a profile of the creek bed and elevations of the sediment surface was completed in the lower portion Woodbridge Creek and partway into the Arthur Kill to facilitate delineation of the extent of Woodbridge Creek soft sediment at its confluence with Arthur Kill. The sediment elevations established by the bathymetric survey indicate that the surface profile of the sediment in this area abruptly drops over 30 feet to the bottom of the Arthur Kill. The bathymetric profile indicates that the eastern extent of the Woodbridge Creek sediments likely terminates at the channel scarp of the Arthur Kill where they were subject to tidal erosion force and historical dredging activities.

<u>Spa Spring Creek Background</u>

Summary statistics for the COPECs in the Spa Spring Creek background sediment samples collected in 2014 are as follows:

	Standards/Criteria		Site Data Summary					Frequency		
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	4	0	0.235	0.065	2	50%	2	0
Anthracene	0.085	1.1	4	0.027	0.277	0.108	4	100%	1	0
Arsenic	8.2	70	4	3.8	11.3	7.4	4	100%	2	0
Benzo(a)pyrene	0.43	1.6	4	0.166	0.465	0.3015	4	100%	1	0
Benzo(a)anthracene	0.261	1.6	4	0.151	0.475	0.285	4	100%	2	0

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Benzo(ghi)perylene	0.17	--	4	0.136	0.317	0.223	4	100%	2	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	4	0.115	0.476	0.2565	4	100%	2	0
Chrysene	0.384	2.8	4	0.21	0.601	0.3955	4	100%	2	0
Cobalt	--	10	4	12.3	14.5	13.3	4	100%	NA	4
Copper	34	270	4	28.6	41.4	33.5	4	100%	1	0
Dibenz(a,h)anthracene	0.063	0.26	4	0.03	0.082	0.056	4	100%	2	0
EPH, Total Fractionated	--	--	4	39.4	121	74.1	4	100%	NA	NA
Fluoranthene	0.6	5.1	4	0.365	1.24	0.7205	4	100%	2	0
Fluorene	0.019	0.54	4	0	0.208	0.063	3	75%	2	0
Indeno(1,2,3-cd)pyrene	0.2	--	4	0.101	0.32	0.2115	4	100%	2	NA
2-Methylnaphthalene	0.07	0.67	4	0	0.438	0.1095	1	25%	1	0
Naphthalene	0.16	2.1	4	0	0.268	0.067	1	25%	1	0
Nickel	21	52	4	15.7	27.1	21.8	4	100%	2	0
Phenanthrene	0.24	1.5	4	0.13	1.15	0.4915	4	100%	3	0
Pyrene	0.665	2.6	4	0.346	1.09	0.664	4	100%	2	0
Silver	1	3.7	4	0	1.2	0.875	3	75%	3	0
Total PAHs	4	45	4	2.16	7.988	4.30	4	100%	2	0
Zinc	150	410	4	131	664	288	4	100%	2	1

COPECs identified in the Spa Spring Creek background sediment in the 2014 SEE included PAHs, EPH, and metals. Total PAH concentrations were relatively low, ranging from 2.16 to 7.98 mg/kg. EPH was detected at concentrations ranging from 39.4 to 121 mg/kg, and of the metals, only zinc was detected above the ER-M (1 of 4 samples). It should be noted that in general, the mean concentration of the COPECs were similar to the ER-L concentrations, with several (e.g., arsenic, copper, zinc, below the ER-L, and others nearly the same (e.g., nickel, pyrene, total PAHs).

Woodbridge Creek

Summary statistics for the COPECs in Woodbridge Creek sediment samples collected in 2014 are as follows:

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	2	0	1.26	0.63	1	50%	1	1
Anthracene	0.085	1.1	2	3.16	3.55	3.355	2	100%	2	2
Antimony	--	9.3	2	4.1	9.5	6.8	2	100%	NA	1
Arsenic	8.2	70	2	47.6	62.3	54.95	2	100%	2	0
Barium	--	48	2	161	213	187	2	100%	NA	2
Benzene	0.34	--	2	0.173	0.437	0.305	2	100%	1	NA

COPEC (mg/kg)	Standards/Criteria		Site Data Summary					Frequency		
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Benzo(a)pyrene	0.43	1.6	2	6.24	10.6	8.42	2	100%	2	2
Benzo(a)anthracene	0.261	1.6	2	4.63	7.03	5.83	2	100%	2	2
Benzo(b)fluoranthene	--	1.8	2	3.91	6.94	5.425	2	100%	NA	2
Benzo(ghi)perylene	0.17	--	2	5.08	12.8	8.94	2	100%	2	NA
Benzo(k)fluoranthene	0.24	--	2	0.853	0.882	0.8675	2	100%	2	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	2	7.01	23.5	15.255	2	100%	2	2
Cadmium	1.2	9.6	2	5.6	10	7.8	2	100%	2	1
Chromium	81	370	2	72.4	99.1	85.75	2	100%	1	0
Chrysene	0.384	2.8	2	6.96	11.7	9.33	2	100%	2	2
Cobalt	--	10	2	0	11	5.5	1	50%	NA	1
Copper	34	270	2	337	447	392	2	100%	2	2
Dibenz(a,h)anthracene	0.063	0.26	2	1.67	2.92	2.295	2	100%	2	2
1,2-Dichlorobenzene	--	0.013	2	0	0.0781	0.039	1	50%	NA	1
1,4-Dichlorobenzene	--	0.11	2	0.391	0.971	0.681	2	100%	NA	2
EPH, Total Fractionated	--	--	12	1640	59300	16270	12	100%	NA	NA
Ethylbenzene	1.4	--	2	1.23	2.27	1.75	2	100%	1	NA
Fluoranthene	0.6	5.1	2	5.1	6.63	5.865	2	100%	2	1
Fluorene	0.019	0.54	2	0	2.57	1.285	1	50%	1	1
Indeno(1,2,3-cd)pyrene	0.2	--	2	1.79	2.89	2.34	2	100%	2	NA
Lead	47	218	2	166	817	491.5	2	100%	2	1
Mercury	0.15	0.71	2	1.7	7.1	4.4	2	100%	2	2
2-Methylnaphthalene	0.07	0.67	2	14.5	14.9	14.7	2	100%	2	2
Naphthalene	0.16	2.1	2	3.12	4.06	3.59	2	100%	2	2
Nickel	21	52	2	53.1	91.7	72.4	2	100%	2	2
Phenanthrene	0.24	1.5	2	12.6	19.2	15.9	2	100%	2	2
Pyrene	0.665	2.6	2	12	13.1	12.55	2	100%	2	2
Selenium	--	1	2	18.4	27.2	22.8	2	100%	NA	2
Silver	1	3.7	2	1.1	2	1.55	2	100%	2	0
Total PAHs	4	45	2	86.78	115.86	101.32	2	100%	2	2
Vanadium	--	57	2	59.3	59.8	59.55	2	100%	NA	2
Zinc	150	410	2	375	476	425.5	2	100%	2	1
Xylenes (total)	0.12	--	2	4.66	9.67	7.165	2	100%	2	NA

Woodbridge Creek sediment COPECs included VOCs (primarily BTEX compounds), SVOCs (mainly the PAHs), metals, and EPH. However, only two samples were analyzed in Woodbridge Creek for SVOCs and metals; these were collected along transect SED-19 to address data gaps as noted in the 2016 SEER. EPH was detected in 12 sediment samples collected from Woodbridge Creek, with a mean concentration of 16,270 mg/kg.

The SEER also concluded that the water body sediment samples collected in 2014 contained DAP-related COPECs similar to those associated with typical urban stream sediments (e.g., PAHs, metals).

5.3 Summary of 2019 Supplemental Sediment Investigation (FSSI)

As described in the approved SFSAP, objectives of the 2019 SSI include providing supplemental information to address data gaps identified by the USEPA and NJDEP related to prior sediment investigations in Spa Spring Creek and Woodbridge Creek, and to satisfy the investigation requirements of the Facility HSWA Permit. The SSI data are intended to supplement data obtained for Spa Spring Creek and Woodbridge Creek during the prior investigations conducted in 2002 and 2014. The SSI was implemented following submission, revision, and approval of the SFSAP in September 2019, and with respect to the previously noted discussions and correspondence with the USEPA and NJDEP. Additional details regarding the 2019 FSSI are provided in the 2019 Supplemental Sediment Investigation Report (SSIR) enclosed as Appendix C.

The SSI included a bathymetric survey of the entire length of Woodbridge Creek from Woodbridge Avenue upstream of the Facility to the mouth of the Arthur Kill that was used to prepare sediment cross sections over the studied reaches of Woodbridge Creek (Figures C-2 through C-4).

Sediment samples for laboratory analysis were collected from 60 previously selected locations as summarized on Table I. The SSI included collection of 169 sediment samples, and nine duplicate samples. All field activities were completed by October 31, 2019. Additional background sediment samples were collected from both Spa Spring Creek (Samples SSBG-1 – SSBG-4), and Woodbridge Creek (WCBG-1 – WCBG-10) given the history of industry and urbanization in upstream areas and to enhance the existing background data set.

Visual inspection and screening of sediment cores in the field identified sheen, staining, or odors suggesting petroleum-related contamination in approximately 50% of the borings advanced in 2019. However, these features were discontinuous and the feature most commonly encountered was slight to moderate sheen, with few borings containing all three.

Analytical results for the sediment samples were compared to the ESCs as per the EETG (Tables II-VI). The Spa Spring Creek background samples were collected in the reach of the creek west of the Pennsylvania RR embankment and culverts (off-Facility property). The Woodbridge Creek background samples were collected in an area just downstream of the Woodbridge Avenue crossing and several thousand feet upstream of the Facility. Sampling vessel passage and sampling beyond Woodbridge Avenue was not possible. Surface water quality field measurements were made at selected points along sediment transects in Woodbridge and Spa Spring Creeks as part of the SSI, with results provided on Table C-XXII.

Appendix C, Table C-I provides 2019 sample information including sample geographic coordinates, sample depths, dates of sampling, and analytical parameters. Figures 3-11 show the location and analytical results for sediment samples collected in Spa Spring Creek and Woodbridge Creek in 2019 and in the prior years. Tables C-II-CXXII provide laboratory analytical results for the 2019 sediment samples and water quality measurements. Summary statistics for sediment analytical results are provided below.

<u>Spa Spring Creek</u>

Summary statistics for COPECs in Spa Spring Creek background sediment samples collected in 2019 are as follows:

	Standards/Criteria		Site Data Summary				Frequency			
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	#%Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	13	0	0.63	0.11	7	54%	7	1
Acenaphthylene	0.044	0.64	13	0	0.063	0.018	5	38%	3	0
Anthracene	0.085	1.1	13	0	1.1	0.309	10	77%	7	0
Arsenic	8.2	70	13	2.82	9.64	5.72	13	100%	3	0
Barium	--	48	13	21.6	71.2	35.3	13	100%	NA	3
Benzo(a)pyrene	0.43	1.6	13	0	1.9	0.63	10	77%	6	1
Benzo(a)anthracene	0.261	1.6	13	0	2	0.685	11	85%	8	2
Benzo(b)fluoranthene	--	1.8	13	0	2.3	0.861	10	77%	NA	3
Benzo(ghi)perylene	0.17	--	13	0	1.3	0.447	10	77%	8	NA
Benzo(k)fluoranthene	0.24	--	13	0	0.9	0.341	10	77%	7	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	13	0	6.4	0.492	1	8%	1	1
Chrysene	0.384	2.8	13	0	2.5	0.789	11	85%	8	0
Cobalt	--	10	13	7.5	22.5	12.1	13	100%	NA	10
Copper	34	270	13	17.9	105	38.3	13	100%	5	0
Dibenz(a,h)anthracene	0.063	0.26	13	0	0.36	0.109	7	54%	7	2
EPH, Total Fractionated	--	--	13	4.7	1200	153	9	69%	NA	NA
Fluoranthene	0.6	5.1	13	0	5.5	1.79	12	92%	7	1
Fluorene	0.019	0.54	13	0	0.61	0.132	9	69%	8	1
Indeno(1,2,3-cd)pyrene	0.2	--	13	0	0.98	0.392	10	77%	8	NA
Lead	47	218	13	12.4	184	54.9	13	100%	4	0
2-Methylnaphthalene	0.07	0.67	13	0	0.56	0.062	6	46%	2	0
Naphthalene	0.16	2.1	13	0	0.23	0.044	6	46%	1	0
Nickel	21	52	13	12.1	41.7	21.3	13	100%	3	0
Phenanthrene	0.24	1.5	13	0.005	4.7	1.07	13	100%	7	4
Pyrene	0.665	2.6	13	0	4.2	1.40	12	92%	8	3
Total PAHs	4	45	13	0.005	29.73	9.18	13	100%	7	0
Zinc	150	410	13	63.7	363	157	13	100%	5	0

The COPECs detected in the background sediment samples collected from Spa Spring Creek include the PAHs, EPH, and metals, generally consistent with what was detected in Woodbridge Creek and the Arthur Kill. The background samples were obtained from areas upstream of the railroad culverts and downstream of Amboy Avenue (Figures 4 and 11). Those COPECs detected above both the ER-L and ER-M include PAHs, and several metals, notably cobalt. EPH, which has no criteria was detected at relatively low concentrations, with a mean concentration of 153 mg/kg. Other COPECs were detected above the ER-M but at lower frequencies, and the mean concentrations of 22 of the 27 detected COPECs were less than their respective ER-M.

Summary statistics for COPECs in Spa Spring Creek sediment samples collected in 2019 are as follows:

	Standards/Criteria		Site Data Summary				Frequency			
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Arsenic	8.2	70	7	0	34.6	8.41	6	86%	2	0
Barium	--	48	7	15.6	378	142	7	100%	NA	5
Cobalt	--	10	7	4.13	13.9	8.94	7	100%	NA	2
EPH, Total Fractionated	--	--	19	0	250	28.2	11	58%	NA	NA
Nickel	21	52	7	9.75	32.4	19.1	7	100%	2	0
Silver	1	3.7	7	0	1.66	0.307	2	29%	1	0

Supplemental sediment samples collected in the reach of Spa Spring Creek adjacent to the Facility (i.e., samples at SED-07, SED-08, and SED-11) were analyzed for VOCs, SVOCs, EPH and metals. Only five COPECs were detected that included only metals. EPH was detected at low concentrations, with a maximum concentration of 250 mg/kg.

<u>Woodbridge Creek</u>

Summary statistics for COPECs in Woodbridge Creek background sediment samples collected in 2019 are as follows:

	Standards/Criteria		Site Data Summary				Frequency			
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	20	0	0.56	0.042	3	15%	3	1
Acenaphthylene	0.044	0.64	20	0	0.51	0.028	3	15%	1	0
Anthracene	0.085	1.1	20	0	5.1	0.373	15	75%	6	2
Arsenic	8.2	70	20	3.09	40.5	11.6	20	100%	9	0
Barium	--	48	20	16.7	147	58.0	20	100%	NA	9
Benzo(a)pyrene	0.43	1.6	20	0	14	0.996	17	85%	5	2
Benzo(a)anthracene	0.261	1.6	20	0	16	1.11	16	80%	8	2
Benzo(b)fluoranthene	--	1.8	20	0	18	1.23	17	85%	NA	2
Benzo(ghi)perylene	0.17	--	20	0	8.5	0.6614	16	80%	7	NA
Benzo(k)fluoranthene	0.24	--	20	0	6.3	0.428	14	70%	4	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	20	0	4.1	0.629	7	35%	6	3
Cadmium	1.2	9.6	20	0	9.98	1.23	11	55%	6	1
Chrysene	0.384	2.8	20	0	14	0.996	17	85%	7	1
Cobalt	--	10	20	5.03	45	11.4	20	100%	NA	8
Copper	34	270	20	9.94	2090	188	20	100%	12	3
Dibenz(a,h)anthracene	0.063	0.26	20	0	2	0.1507	9	45%	7	3
EPH, Total Fractionated	--	--	36	0	3400	616	28	78%	NA	NA
Fluoranthene	0.6	5.1	20	0	32	2.12	19	95%	6	1
Fluorene	0.019	0.54	20	0	1.4	0.0842	5	25%	3	1
Indeno(1,2,3-cd)pyrene	0.2	--	20	0	6.6	0.4757	16	80%	6	NA
Lead	47	218	20	7.07	328	84.0	20	100%	11	2

COPEC (mg/kg)	Standards/Criteria		Site Data Summary					Frequency		
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Mercury	0.15	0.71	20	0	1.19	0.243	16	80%	7	4
Nickel	21	52	20	8.46	194	38.9	20	100%	10	3
Phenanthrene	0.24	1.5	20	0	8.2	0.522	14	70%	4	1
Pyrene	0.665	2.6	20	0	23	1.72	19	95%	6	2
Selenium	--	1	20	0	8.13	0.51	2	10%	NA	2
Silver	1	3.7	20	0	2.93	0.679	11	55%	5	0
Total PAHs	4	45	20	0	156.36	11.0	19	95%	6	1
Vanadium	--	57	20	16.5	78.6	32.0	20	100%	NA	2
Zinc	150	410	20	38.4	1400	307	20	100%	10	5

In the background samples, the SVOCs (mainly PAHs) and metals were detected above the ER-L and ER-M; however, the frequency of those COPECs is generally low. EPH was detected from 0 to 3,400 mg/kg, at an average concentration of 616.27 mg/kg.

Summary statistics for COPECs in Woodbridge Creek sediment samples collected in 2019 are as follows:

COPEC (mg/kg)	Standards/Criteria		Site Data Summary					Frequency		
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	53	0	1.7	0.166	23	43%	21	7
Acenaphthylene	0.044	0.64	53	0	0.87	0.054	14	26%	8	1
Anthracene	0.085	1.1	53	0	2.5	0.493	47	89%	40	6
Antimony	--	9.3	54	0	26.6	3.29	22	41%	NA	5
Arsenic	8.2	70	54	3.65	1100	78.2	54	100%	48	15
Barium	--	48	54	12.3	502	158	54	100%	NA	44
Benzene	0.34	--	52	0	8.8	0.306	22	42%	6	NA
Benzo(a)pyrene	0.43	1.6	53	0	2.2	0.517	48	91%	29	2
Benzo(a)anthracene	0.261	1.6	53	0	2.3	0.646	50	94%	40	3
Benzo(b)fluoranthene	--	1.8	53	0	2.6	0.639	49	92%	NA	1
Benzo(ghi)perylene	0.17	--	53	0	1.8	0.447	48	91%	37	NA
Benzo(k)fluoranthene	0.24	--	53	0	0.72	0.189	39	74%	17	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	53	0	48	2.91	33	62%	33	14
Cadmium	1.2	9.6	54	0	15.2	3.61	49	91%	36	3
Chromium	81	370	54	13.2	230	77.8	54	100%	24	0
Chrysene	0.384	2.8	53	0	2.8	0.861	51	96%	36	0
Cobalt	--	10	54	5.04	59.6	14.1	54	100%	NA	43
Copper	34	270	54	21.1	2400	588	54	100%	53	33
Dibenz(a,h)anthracene	0.063	0.26	53	0	0.31	0.073	29	55%	26	2
1,2-Dichlorobenzene	--	0.013	52	0	0.29	0.017	9	17%	NA	6

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
1,4-Dichlorobenzene	--	0.11	52	0	0.37	0.035	18	35%	NA	4
EPH, Total Fractionated	--	--	88	0	33000	4864	85	97%	NA	NA
Ethylbenzene	1.4	--	52	0	10	0.698	21	40%	5	NA
Fluoranthene	0.6	5.1	53	0.01	3.1	1.14	53	100%	36	0
Fluorene	0.019	0.54	53	0	3	0.488	38	72%	35	16
Indeno(1,2,3-cd)pyrene	0.2	--	53	0	1.2	0.259	42	79%	29	NA
Lead	47	218	54	14.7	1160	256	54	100%	51	25
Mercury	0.15	0.71	54	0	8.62	2.51	52	96%	47	37
2-Methylnaphthalene	0.07	0.67	53	0	24	2.50	43	81%	33	20
Naphthalene	0.16	2.1	53	0	6.3	0.562	33	62%	20	4
Nickel	21	52	54	26.3	567	86.4	54	100%	54	28
Phenanthrene	0.24	1.5	53	0	11	1.83	51	96%	41	20
Pyrene	0.665	2.6	53	0	4.4	1.54	52	98%	38	9
Selenium	--	1	54	0	139	11.3	32	59%	NA	32
Silver	1	3.7	54	0	15.9	2.80	45	83%	37	16
Toluene	2.5	--	52	0	12	0.445	14	27%	3	NA
Total PAHs	4	45	53	0.05	61.14	12.4	53	100%	42	2
Vanadium	--	57	54	13.9	92.7	51.9	54	100%	NA	23
Zinc	150	410	54	85.2	1820	495	54	100%	48	27
Xylenes (total)	0.12	--	53	0	56	3.91	36	68%	28	NA

The COPECs detected in Woodbridge Creek sediment samples differ somewhat from those detected in the background samples, particularly the VOCs (BTEX), and the PAHs (1,2- and 1,4-dichlorobenzene, 2-methylnaphthalene, naphthalene), which were not detected in background samples. EPH was detected at higher concentrations, from 0-33,000 mg/kg, with a mean concentration of 4,864.45 mg/kg. Several metals were detected above their respective ER-M and ER-L. The frequency of COPECs detected above their ER-M in the Woodbridge Creek non-background samples is also generally higher than that for the background samples. It should be noted that for both sets of data, the mean concentrations of most COPECs are less than their respective ER-M, and some are less than the ER-L.

5.4 Evaluation of Combined 2002, 2014 and 2019 Sediment Investigation Data

This section provides an evaluation of the Spa Spring Creek and Woodbridge Creek sediment data combined from all the three investigative phases, 2002, 2014, and 2019. As noted in Section 5.1 above, further investigation of the Arthur Kill is not warranted.

<u>Spa Spring Creek</u>

Summary statistics for COPECs detected in sediment samples collected in the background reach of Spa Spring Creek in 2014 and 2019 are as follows:

COPEC (mg/kg)	Standards/Criteria		Site Data Summary					Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	95UCL	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	17	0	0.63	0.099	0.273	9	53%	9	1
Acenaphthylene	0.044	0.64	17	0	0.063	0.014	0.038	5	29%	3	0
Anthracene	0.085	1.1	17	0	1.1	0.261	0.63	14	82%	8	0
Arsenic	8.2	70	17	2.82	11.3	6.11	7.22	17	100%	5	0
Barium	--	48	17	0	71.2	30.3	37.9	15	88%	NA	3
Benzo(a)pyrene	0.43	1.6	17	0	1.9	0.553	1.17	14	82%	7	1
Benzo(a)anthracene	0.261	1.6	17	0	2	0.591	1.28	15	88%	10	2
Benzo(b)fluoranthene	--	1.8	17	0	2.3	0.753	1.57	14	82%	NA	3
Benzo(ghi)perylene	0.17	--	17	0	1.3	0.394	0.81	14	82%	10	NA
Benzo(k)fluoranthene	0.24	--	17	0	0.9	0.293	0.42	14	82%	7	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	17	0	6.4	0.437	2.07	5	29%	3	1
Chrysene	0.384	2.8	17	0	2.5	0.697	1.47	15	88%	10	0
Cobalt	--	10	17	7.5	22.5	12.4	13.8	17	100%	NA	14
Copper	34	270	17	17.9	105	37.2	46.5	17	100%	6	0
Dibenz(a,h)anthracene	0.063	0.26	17	0	0.36	0.097	0.15	11	65%	9	2
EPH, Total Fractionated	--	--	17	4.7	1200	134	435.9	17	100%	NA	NA
Fluoranthene	0.6	5.1	17	0	5.5	1.54	3.37	16	94%	9	1
Fluorene	0.019	0.54	17	0	0.61	0.115	0.29	12	71%	10	1
Indeno(1,2,3-cd)pyrene	0.2	--	17	0	0.98	0.35	0.702	14	82%	10	NA
Lead	47	218	17	12.4	184	50.9	76.67	17	100%	4	0
2-Methylnaphthalene	0.07	0.67	17	0	0.56	0.073	0.247	7	41%	3	0
Naphthalene	0.16	2.1	17	0	0.268	0.05	0.137	7	41%	2	0
Nickel	21	52	17	12.1	41.7	21.5	25.07	17	100%	5	0
Phenanthrene	0.24	1.5	17	0.005	4.7	0.931	2.03	17	100%	10	4
Pyrene	0.665	2.6	17	0	4.2	1.23	2.55	16	94%	10	3
Silver	1	3.7	17	0	1.2	0.628	1.107	12	71%	3	0
Total PAHs	4	45	17	0.005	29.73	8.04	17.23	17	100%	9	0
Zinc	150	410	17	63.7	664	188	259.5	17	100%	7	1

In contrast to the combined data for the Facility reach of Spa Spring Creek, the combined data for the background reach indicates that the PAHs are present above the ER-L and ER-M, as applicable, with few metals (barium, cobalt, and zinc) present above the ER-L and ER-M. The relative absence of PAHs downstream in the Facility reach is a further indication that Spa Spring Creek is not a significant source of COPECs in Woodbridge Creek. The 95UCL values were calculated using USEPA ProUCL (see Section 4 and Attachment 3).

The following are combined summary statistics for COPECs detected in sediment samples collected in Spa Spring Creek for 2002 and 2019:

COPEC (mg/kg)	Standards/Criteria		Site Data Summary				Frequency			
	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	13	0	0.017	0.003	3	23%	1	0
Acenaphthylene	0.044	0.64	13	0	0.083	0.008	2	15%	1	0
Anthracene	0.085	1.1	13	0	0.13	0.014	3	23%	1	0
Arsenic	8.2	70	13	0	164	20.7	12	92%	7	1
Barium	--	48	13	15.6	378	113	13	100%	NA	10
Benzo(a)pyrene	0.43	1.6	13	0	0.45	0.056	7	54%	1	0
Benzo(a)anthracene	0.261	1.6	13	0	0.29	0.037	4	31%	1	0
Benzo(ghi)perylene	0.17	--	13	0	0.74	0.079	6	46%	2	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	13	0	0.86	0.105	2	15%	2	0
Cadmium	1.2	9.6	13	0	2.5	0.647	6	46%	3	0
Chromium	81	370	13	12.1	133	33.5	13	100%	1	0
Chrysene	0.384	2.8	13	0	0.39	0.057	9	69%	1	0
Cobalt	--	10	13	4.13	36.7	13.1	13	100%	NA	7
Copper	34	270	13	0	494	55.9	11	85%	2	1
Dibenz(a,h)anthracene	0.063	0.26	13	0	0.15	0.0159	3	23%	1	0
EPH, Total Fractionated	--	--	19	0	250	28.2	11	58%	NA	NA
Fluorene	0.019	0.54	13	0	0.031	0.005	4	31%	1	0
Indeno(1,2,3-cd)pyrene	0.2	--	13	0	0.37	0.047	7	54%	1	NA
Lead	47	218	13	5.09	656	66.2	13	100%	1	1
Mercury	0.15	0.71	13	0	2.6	0.2146	4	31%	1	1
Nickel	21	52	13	9.75	85.1	31.6	13	100%	7	2
Phenanthrene	0.24	1.5	13	0	0.31	0.045	8	62%	1	0
Silver	1	3.7	13	0	2.1	0.327	3	23%	2	0
Total PAHs	4	45	13	0	4.891	0.649	11	85%	1	0
Vanadium	--	57	13	14.6	109	45	13	100%	NA	1
Zinc	150	410	13	23.4	1140	189	13	100%	2	2

The combined data for the Facility reach of Spa Spring Creek indicates that several of the metals, e.g., barium, cobalt, nickel and zinc are present in sediments above the ER-L and ER-M, whereas the PAHs were present only above the ER-L. EPH, which has no criteria, was detected at fairly low concentrations, and with a mean of 28.16 mg/kg. This data suggests that Spa Spring Creek is not a significant source of the COPECs detected in Woodbridge Creek sediments. The sample data shown on Figure 3 indicates that PAHs are absent as COPECs in the Facility reach, with metals being the only COPECs.

Woodbridge Creek

The following are summary statistics for combined COPEC data for background sediment samples collected from Woodbridge Creek in 2002 and 2019:

	Standards/Criteria		Site Data Summary					Frequency			
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	95UCL	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	23	0	0.56	0.04	0.153	6	26%	5	1
Acenaphthylene	0.044	0.64	23	0	0.51	0.027	0.123	6	26%	1	0
Anthracene	0.085	1.1	23	0	5.1	0.335	1.32	18	78%	7	2
Arsenic	8.2	70	23	3.09	40.5	10.7	14.63	23	100%	9	0
Barium	--	48	23	10.7	147	52.2	67.61	23	100%	NA	9
Benzo(a)pyrene	0.43	1.6	23	0	14	0.912	3.533	20	87%	6	2
Benzo(a)anthracene	0.261	1.6	23	0	16	1.00	4.013	19	83%	9	2
Benzo(b)fluoranthene	--	1.8	23	0	18	1.14	4.517	20	87%	NA	2
Benzo(ghi)perylene	0.17	--	23	0	8.5	0.596	2.193	19	83%	8	NA
Benzo(k)fluoranthene	0.24	--	23	0	6.3	0.395	1.58	17	74%	5	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	23	0	5.2	0.837	2.266	10	43%	9	4
Cadmium	1.2	9.6	23	0	9.98	1.12	3.112	14	61%	6	1
Chrysene	0.384	2.8	23	0	14	0.926	3.552	20	87%	8	1
Cobalt	--	10	23	5.03	45	10.9	13.79	23	100%	NA	8
Copper	34	270	23	9.94	2090	172	563.3	23	100%	15	3
Dibenz(a,h)anthracene	0.063	0.26	23	0	2	0.137	0.514	12	52%	8	3
EPH, Total Fractionated	--	--	36	0	3400	616	1293	28	78%	NA	NA
Fluoranthene	0.6	5.1	23	0	32	1.92	7.952	22	96%	7	1
Fluorene	0.019	0.54	23	0	1.4	0.077	0.342	8	35%	4	1
Indeno(1,2,3-cd)pyrene	0.2	--	23	0	6.6	0.433	1.67	19	83%	7	NA
Lead	47	218	23	7.07	328	81.7	123.5	23	100%	13	2
Mercury	0.15	0.71	23	0	1.19	0.211	0.531	16	70%	7	4
2-Methylnaphthalene	0.07	0.67	23	0	0.22	0.02	0.063	10	43%	1	0
Naphthalene	0.16	2.1	23	0	0.22	0.019	0.0665	7	30%	1	0
Nickel	21	52	23	8.46	194	37.9	49.9	23	100%	13	3
Phenanthrene	0.24	1.5	23	0	8.2	0.498	2.036	17	74%	5	1
Pyrene	0.665	2.6	23	0	23	1.59	5.9	22	96%	7	2
Silver	1	3.7	23	0	2.93	0.598	1.31	12	52%	5	0
Total PAHs	4	45	23	0	156.36	10.1	39.42	22	96%	7	1
Vanadium	--	57	23	13.7	78.6	32.4	39.32	23	100%	NA	3
Zinc	150	410	23	38.4	1400	315	470.7	23	100%	13	7

Based on the summary statistics presented above, COPECs identified in the Woodbridge Creek background sediment samples include EPH, and several metals and PAHs. The 95UCL values were calculated using USEPA ProUCL (see Section 4 and Attachment 3).

The following are summary statistics for combined COPEC data for sediment samples collected from Woodbridge Creek (Upper and Lower Reach) in 2002, 2014, and 2019:

	Standards/Criteria		Site Data Summary				Frequency			
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	# Detected	% Detected	# > ESC ER-L	# > ESC ER-M
Acenaphthene	0.016	0.5	81	0	2.8	0.241	48	59%	43	12
Acenaphthylene	0.044	0.64	81	0	1.2	0.098	40	49%	29	4
Anthracene	0.085	1.1	81	0	3.55	0.583	75	93%	64	12
Antimony	--	9.3	82	0	26.6	2.55	31	38%	NA	6
Arsenic	8.2	70	82	3.65	1100	61.9	82	100%	73	16
Barium	--	48	82	12.3	502	137	82	100%	NA	64
Benzene	0.34	--	80	0	20	0.724	28	35%	11	NA
Benzo(a)pyrene	0.43	1.6	81	0	13	1.10	76	94%	50	10
Benzo(a)anthracene	0.261	1.6	81	0	7.03	0.957	78	96%	64	11
Benzo(b)fluoranthene	--	1.8	80	0	9.6	1.11	76	95%	NA	9
Benzo(ghi)perylene	0.17	--	81	0	18	1.15	76	94%	62	NA
Benzo(k)fluoranthene	0.24	--	81	0	1.3	0.294	67	83%	36	NA
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	81	0	50	4.56	59	73%	57	28
Cadmium	1.2	9.6	82	0	15.2	3.76	77	94%	56	7
Chromium	81	370	82	13.2	230	74.6	82	100%	33	0
Chrysene	0.384	2.8	81	0	11.7	1.39	79	98%	59	5
Cobalt	--	10	82	0	85.9	14.8	81	99%	NA	60
Copper	34	270	82	17.7	8030	636	82	100%	80	53
Dibenz(a,h)anthracene	0.063	0.26	81	0	4	0.25	57	70%	49	13
1,2-Dichlorobenzene	--	0.013	80	0	0.29	0.012	10	13%	NA	7
1,4-Dichlorobenzene	--	0.11	80	0	0.971	0.04	20	25%	NA	6
EPH, Total Fractionated	--	--	100	0	59300	6233	97	97%	NA	NA
Ethylbenzene	1.4	--	80	0	10	0.711	27	34%	9	NA
Fluoranthene	0.6	5.1	81	0.011	6.63	1.47	81	100%	60	2
Fluorene	0.019	0.54	81	0	5.8	0.564	64	79%	57	22
Indeno(1,2,3-cd)pyrene	0.2	--	81	0	4.1	0.492	70	86%	50	NA
Lead	47	218	82	13.5	1160	236	82	100%	77	35
Mercury	0.15	0.71	82	0	8.62	2.24	80	98%	71	52
2-Methylnaphthalene	0.07	0.67	81	0	39	2.97	70	86%	43	27
Naphthalene	0.16	2.1	81	0	10	0.756	57	70%	28	10
Nickel	21	52	82	26.3	2480	119	82	100%	82	47
Phenanthrene	0.24	1.5	81	0	19.2	2.38	79	98%	61	31
Pyrene	0.665	2.6	81	0	13.1	2.33	80	99%	63	21
Selenium	--	1	82	0	154	13.8	59	72%	NA	59
Silver	1	3.7	82	0	15.9	2.47	71	87%	53	22
Toluene	2.5	--	80	0	12	0.353	19	24%	4	NA
Total PAHs	4	45	81	0.045	140.6	18.1	81	100%	66	7
Vanadium	--	57	82	13.9	100	52.0	82	100%	NA	35
Zinc	150	410	82	85.2	2970	486	82	100%	73	39
Xylenes (total)	0.12	--	81	0	56	3.83	43	53%	35	NA

The COPECs detected in the combined and 2019 Woodbridge Creek sediment data include the SVOCs (primarily the PAHs), several metals, and BTEX, consistent with the information previously discussed in Section 5. In general, the mean concentrations of the COPECs in the combined data set are similar to their 2019 counterparts, particularly the organic constituents. EPH is not shown above for 2014, but as noted in Section 5, the data indicates a modest decline in EPH concentrations from an average of 6,233 mg/kg in 2014 to 4,864 mg/kg in 2019.

Because the 2019 samples comprise a large portion of the combined data for Woodbridge Creek sediments, the 2019 data were compared to the 2002 dataset alone (the 2014 data was not further evaluated as most samples were analyzed only for EPH).

The comparison of the 2002/2014 and 2019 Woodbridge Creek COPEC data and summary statistics are as follows:

			Woodbridge Creek 2002 & 2014				Woodbridge Creek 2019			
	Standards/Criteria		Site Data Summary				Site Data Summary			
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	n (site)	Min. Conc.	Max. Conc.	Mean Conc.
Acenaphthene	0.016	0.5	28	0	2.8	0.241	53	0	1.7	0.166
Acenaphthylene	0.044	0.64	28	0	1.2	0.098	53	0	0.87	0.054
Anthracene	0.085	1.1	28	0.003	3.55	0.583	53	0	2.5	0.493
Antimony	--	9.3	28	0	9.5	2.55	54	0	26.6	3.29
Arsenic	8.2	70	28	5.8	91.7	61.9	54	3.65	1100	78.2
Barium	--	48	28	17.1	272	137.4	54	12.3	502	158
Benzene	0.34	--	28	0	20	0.724	52	0	8.8	0.306
Benzo(a)pyrene	0.43	1.6	28	0.01	13	1.10	53	0	2.2	0.517
Benzo(a)anthracene	0.261	1.6	28	0.0081	7.03	0.957	53	0	2.3	0.646
Benzo(b)fluoranthene	--	1.8	27	0.017	9.6	1.11	53	0	2.6	0.639
Benzo(ghi)perylene	0.17	--	28	0.011	18	1.15	53	0	1.8	0.447
Benzo(k)fluoranthene	0.24	--	28	0.0056	1.3	0.294	53	0	0.72	0.189
bis(2-Ethylhexyl)phthalate	0.18216	2.64651	28	0	50	4.56	53	0	48	2.91
Cadmium	1.2	9.6	28	0.68	13	3.76	54	0	15.2	3.61
Chromium	81	370	28	20.5	166	74.6	54	13.2	230	77.8
Chrysene	0.384	2.8	28	0.011	11.7	1.39	53	0	2.8	0.861
Cobalt	--	10	28	0	85.9	14.8	54	5.04	59.6	14.1
Copper	34	270	28	17.7	8030	636	54	21.1	2400	588
Dibenz(a,h)anthracene	0.063	0.26	28	0.0018	4	0.25	53	0	0.31	0.073
EPH, Total Fractionated	--	--	12	1640	59300	16270	88	0	33000	4864
Ethylbenzene	1.4	--	28	0	6.6	0.736	52	0	10	0.698
Fluoranthene	0.6	5.1	28	0.021	6.63	2.10	53	0.011	3.1	1.14
Fluorene	0.019	0.54	28	0	5.8	0.708	53	0	3	0.488
Indeno(1,2,3-cd)pyrene	0.2	--	28	0.0076	4.1	0.932	53	0	1.2	0.259
Lead	47	218	28	13.5	817	197	54	14.7	1160	256
Mercury	0.15	0.71	28	0.03	7.1	1.72	54	0	8.62	2.51
2-Methylnaphthalene	0.07	0.67	28	0	39	3.86	53	0	24	2.50
Naphthalene	0.16	2.1	28	0	10	1.12	53	0	6.3	0.562

	Standards/Criteria		Woodbridge Creek 2002 & 2014 Site Data Summary				Woodbridge Creek 2019 Site Data Summary			
COPEC (mg/kg)	ESC ER-L	ESC ER-M	n (site)	Min. Conc.	Max. Conc.	Mean Conc.	n (site)	Min. Conc.	Max. Conc.	Mean Conc.
Nickel	21	52	28	28.6	2480	181	54	26.3	567	86.4
Phenanthrene	0.24	1.5	28	0.011	19.2	3.41	53	0	11	1.83
Pyrene	0.665	2.6	28	0.027	13.1	3.82	53	0	4.4	1.54
Selenium	--	1	28	0	154	18.7	54	0	139	11.3
Silver	1	3.7	28	0	5.4	1.83	54	0	15.9	2.80
Toluene	2.5	--	28	0	2.9	0.182	52	0	12	0.445
Total PAHs	4	45	28	0.1473	140.57	28.9	53	0.045	61.14	12.4
Vanadium	--	57	28	22.6	100	52.3	54	13.9	92.7	51.9
Zinc	150	410	28	88.9	2970	467	54	85.2	1820	495
Xylenes (total)	0.12	--	28	0	29	3.68	53	0	56	3.91

The above comparison indicates that most COPECs detected in the 2019 sediment samples are at lower mean concentrations than those in the 2002/2014 samples. The COPECs detected at higher concentrations in the 2019 data were mainly the metals (antimony, arsenic, barium, chromium, lead, mercury and silver) above their 2002 concentrations. All but two of the SVOCs detected in 2019 were below the 2002 concentrations, and among the VOCs, only toluene and xylenes were slightly above the 2002 concentrations. As noted in the SEER and RFI report, COPECs detected in the water body sediments are consistent with DAP.

As proposed in Chevron's August 21, 2019 RTC letter, further evaluation of sediment analytical data was completed for sediment samples collected at transects SED-09, SED-23, and SED-24 in Woodbridge Creek. In general, the data indicate that COPEC concentrations in SED-23 and SED-24 samples are slightly higher than at SED-09, with SED-24 samples having the highest concentrations. While these samples were not included in the background data sets, the distribution of COPECs in this portion of Woodbridge Creek indicate a potential source upstream of the Facility in the vicinity of transects SED-09 and SED-24.

6.0 Conclusions

Sediment and surface water samples were collected for laboratory analysis from water body sediments in Woodbridge Creek, Spa Spring Creek, and the Arthur Kill over the course of three separate investigative phases (2002, 2014 and 2019) to meet the water body investigation requirements of the HSWA permit. The investigation included bathymetric surveys and profiling of sediment surfaces in Woodbridge Creek, extensive field and laboratory analysis of sediment and surface water samples in each water body, and a comprehensive data evaluation in conjunction with a review of Facility and regional industrial history and potential contaminant sources. The investigations were undertaken with oversight and approval of the USEPA and NJDEP. This third and final investigative report satisfies the requirements of the HSWA Permit Modification 1 for the full completion of an RFI for the three surface waterbodies.

The following conclusions are based on the laboratory sample analytical results and cumulative investigation findings presented in the previous sections of this report and in the documents referenced in this report as well as the attached Appendices and Attachments .

- Most of the sediment samples collected and analyzed in all three waterbodies have detectible levels of COPECs. Some of the COPECs are anthropogenic petroleum type compounds and metals.

- Surface water sampling and analysis completed in 2003 as part of the RFI/BEE indicated very limited detections of COPECs in surface waters and proposed no further evaluation of surface waters. As described in the approved 2019 SFSAP (and related RTCs), additional surface water evaluation is not warranted, and no further investigation of surface water is proposed.

- The extent of sediment in the Arthur Kill adjacent to the Facility is limited to near-shore deposits that accumulate around ship berths and docks that are periodically dredged to allow tanker berthing. The soft sediments thickness diminishes significantly with distance from the shoreline in this area due to a steep escarpment in the bathymetric surface that exists near the mouth of Woodbridge Creek. Sediment in the Arthur Kill was sampled and analyzed in 2002 and found to contain COPECs similar to those in Spa Spring Creek and Woodbridge Creek sediments, but with higher concentrations in background samples obtained from Arthur Kill upstream and downstream of the Facility. Given these conditions, and the periodic sediment dredging noted in the 2003 RFI and the approved SFSAP, further evaluation of sediments in the Arthur Kill is not warranted. Therefore, no further investigation is proposed for sediments in Arthur Kill.

- The upper layer of sediments in Spa Spring Creek and Woodbridge Creek generally consists of soft, unconsolidated deposits of fine silty sand, silt, and clay materials, with limited coarse fraction components (i.e., medium-coarse sand, gravel) with a variable thickness that ranges generally from 5 to 15 feet. Collectively, these soft sediments represent the medium of concern with respect to the presence of COPECs in the water bodies.

- COPECs are present within the soft sediments of Spa Spring Creek, in background areas and in areas adjacent to the Facility, and include SVOCs (primarily PAHs), EPH, and metals (primarily arsenic, copper, lead, nickel, and zinc). The soft sediment in Spa Spring Creek containing these COPECs extends to the confluence with Woodbridge Creek, and is delineated horizontally bank to bank and vertically to the underlying dense clay.

- The COPECs present within the soft sediments in Woodbridge Creek include VOCs (primarily BTEX compounds), SVOCs (primarily PAHs), EPH, and metals (primarily arsenic, copper, lead, nickel, and zinc). The sediment COPEC concentrations in areas adjacent to and down-stream of the Facility (e.g., Upper Reach, Lower Reach) are generally higher than concentrations in the background sediments. Specifically, EPH concentrations are elevated in the portion of Upper Reach of Woodbridge Creek adjacent to the Facility.

- The characterization and distribution of COPECs in soft sediments within the three-surface water bodies was investigated and completed. The COPEC distribution adjacent to and in the vicinity of the facility is shown on Figures 2-10. Soft sediments are limited vertically by the contact with underlying regional glacial till and marine clay formations, generally determined in the field by depth of core refusal. The soft sediment deposits are delineated horizontally within the banks of Woodbridge Creek from the background reach, and downstream to the Arthur Kill based on bathymetry. The soft sediments have been horizontally delineated bank to bank in Spa Spring Creek where they are generally thin over more competent clayey deposits.

- Notwithstanding the presence of COPECs at elevated concentrations in sediments near the Facility, identification of COPECs in both background area and upstream sediments indicates some portion of the existing COPECs and/or COPEC concentrations is likely associated with off-Site facilities and/or regional, non-point sources (e.g., DAP). This is not surprising given the Facility's location in an urbanized setting with a long industrial history.

Based on the findings of the three investigation phases (2002, 2014, 2019) and review of the combined laboratory sample analytical results described in the FSSIR, the water body investigation requirements of the HSWA Permit have been met. The sediment quality has been characterized with the identification of COPECs in areas adjacent to the Facility and documentation of background sediment quality. The delineation of the soft sediments is completed, identifying COPECs in the bank-to-bank soft sediments based on sediment core refusal and bathymetric surveys. As a result of this comprehensive review of the existing Facility information and data, and based on the laboratory sample analytical results, further evaluation of the water bodies is not warranted. Therefore, no further investigation of the water bodies is proposed.

7.0 References

Chevron, 2003 – North Field Basin Surge Pond Closure Project, Perth Amboy, New Jersey Revised Design: Evaluation of Barrier Wall Alternatives

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Chevron, 2008. Supplemental RCRA Facility Investigation Report. February 2008.

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Ebasco Services, Inc, 1990. Subsurface Investigation and Foundation Evaluation for the Linden Cogeneration Transmission Cable, November 1990.

NJDEP, Protocol for Addressing Extractable Petroleum Hydrocarbons (Version 5.0). Site Remediation Program. August 9, 2010.

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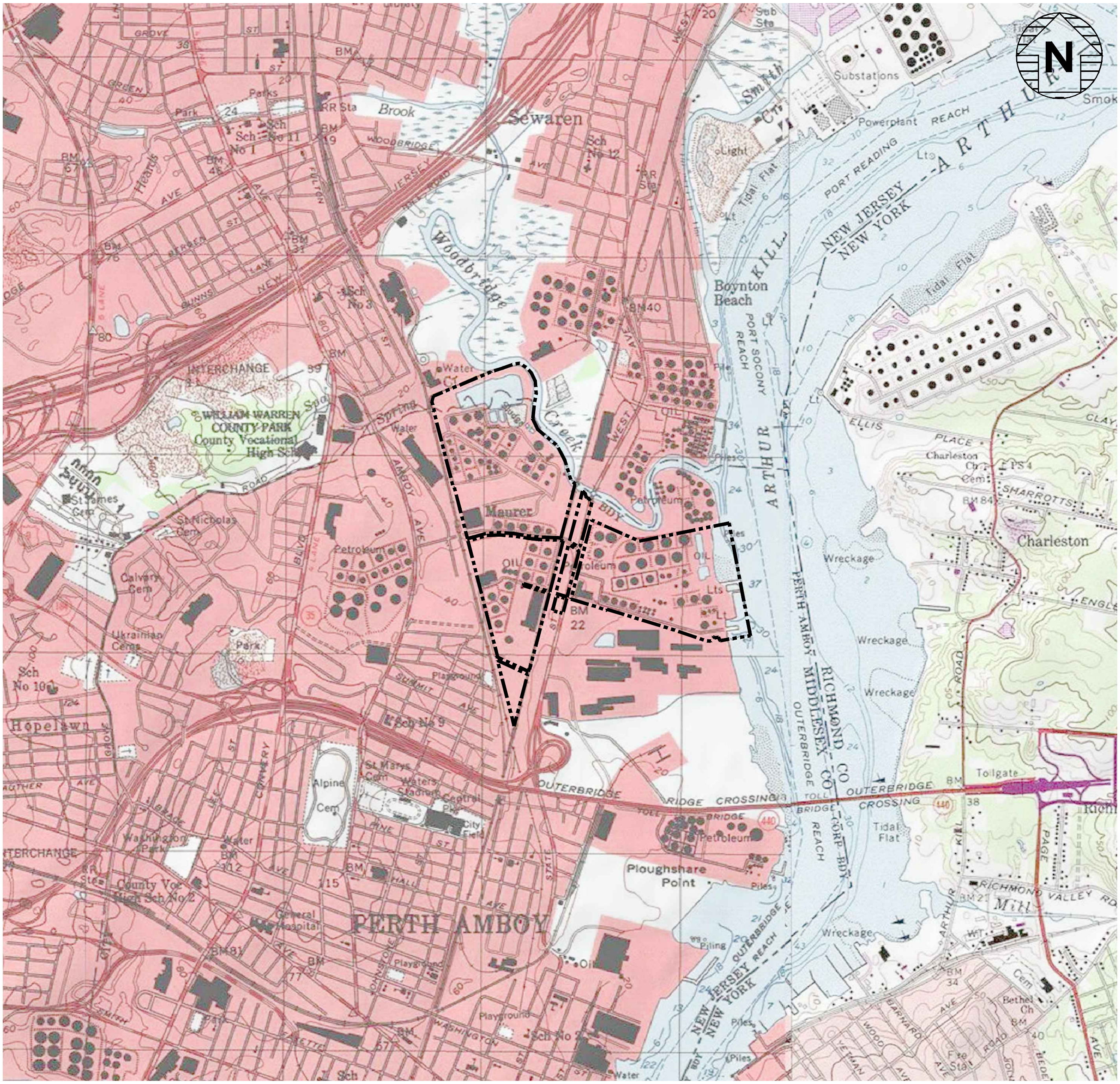
ROUX, 2005. North Field Extension Site. Prepared for Chevron. March 1, 2005.

USEPA, 2015. ProUCL Statistical Software ver. 5.1, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations. October 2015.



SOURCE: PERTH AMBOY, N.J. QUADRANGLE, ARTHUR KILL, N.J. QUADRANGLE, 7.5 MINUTE SERIES (USGS TOPOGRAPHIC MAP)
HTTP://GOTO.ARCGISONLINE.COM/MAPS/USA_TOPO_MAPS

LEGEND

FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY

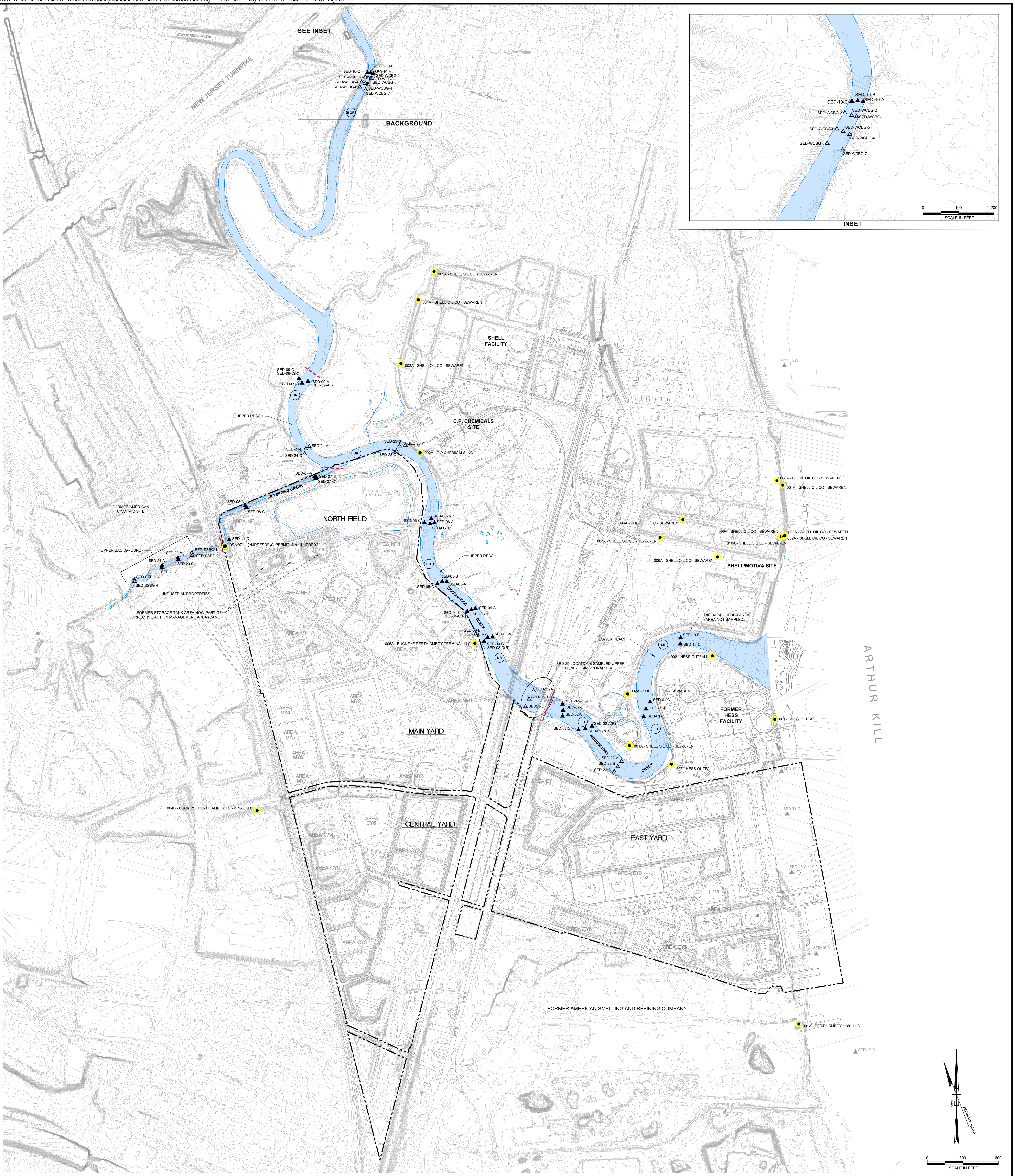
0 2500 FT.

APPROXIMATE SCALE

PROJECT:	CHEVRON FACILITY PERTH AMBOY, NEW JERSEY
TITLE:	FACILITY LOCATION MAP
DRAWN BY: M. GIAMBATTISTA	PROJ NO.: 326731.2020.0000
CHECKED BY: T.REINOLD	FIGURE 1
APPROVED BY: T. REINOLD	
DATE: MAY 2020	
TRC	41 Spring Street Suite 102 New Providence, NJ 07974 Phone: 908.988.1700
FILE NO.:	FIGURE 1.dwg

8.5x11 -- USER: LBochkis -- ATTACHED XREFS: -- ATTACHED IMAGES: O40074E2; O40074E3; topo1; y4_-hwym_400x400;
DRAWING NAME: M:\Cad Files\WORK\8900\2019\Bathymetric\Final\rev. 03.20.20\ FIGURE 1.dwg --- PLOT DATE: May 15, 2020 - 2:00PM --- LAYOUT: Layout1 (2)

Version: 2017-10-21



LEGEND

- FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY
- WATER FEATURE BOUNDARY (APPROXIMATE)
- CREEK REACH BOUNDARY (WOODBRIDGE CREEK, SPA SPRING CREEK)
- SEDIMENT SAMPLE LOCATIONS 2002 (NOT SUBSEQUENTLY SAMPLED)
- SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])
- LOCATIONS SAMPLED PREVIOUSLY IN 2002 OR 2014, RE-SAMPLED IN 2019
- NJDEP DISCHARGE POINT (FORMER OR ACTIVE)
- LR WOODBRIDGE CREEK - LOWER REACH
- UR WOODBRIDGE CREEK - UPPER REACH
- BGR WOODBRIDGE CREEK - BACKGROUND REACH

NOTES:

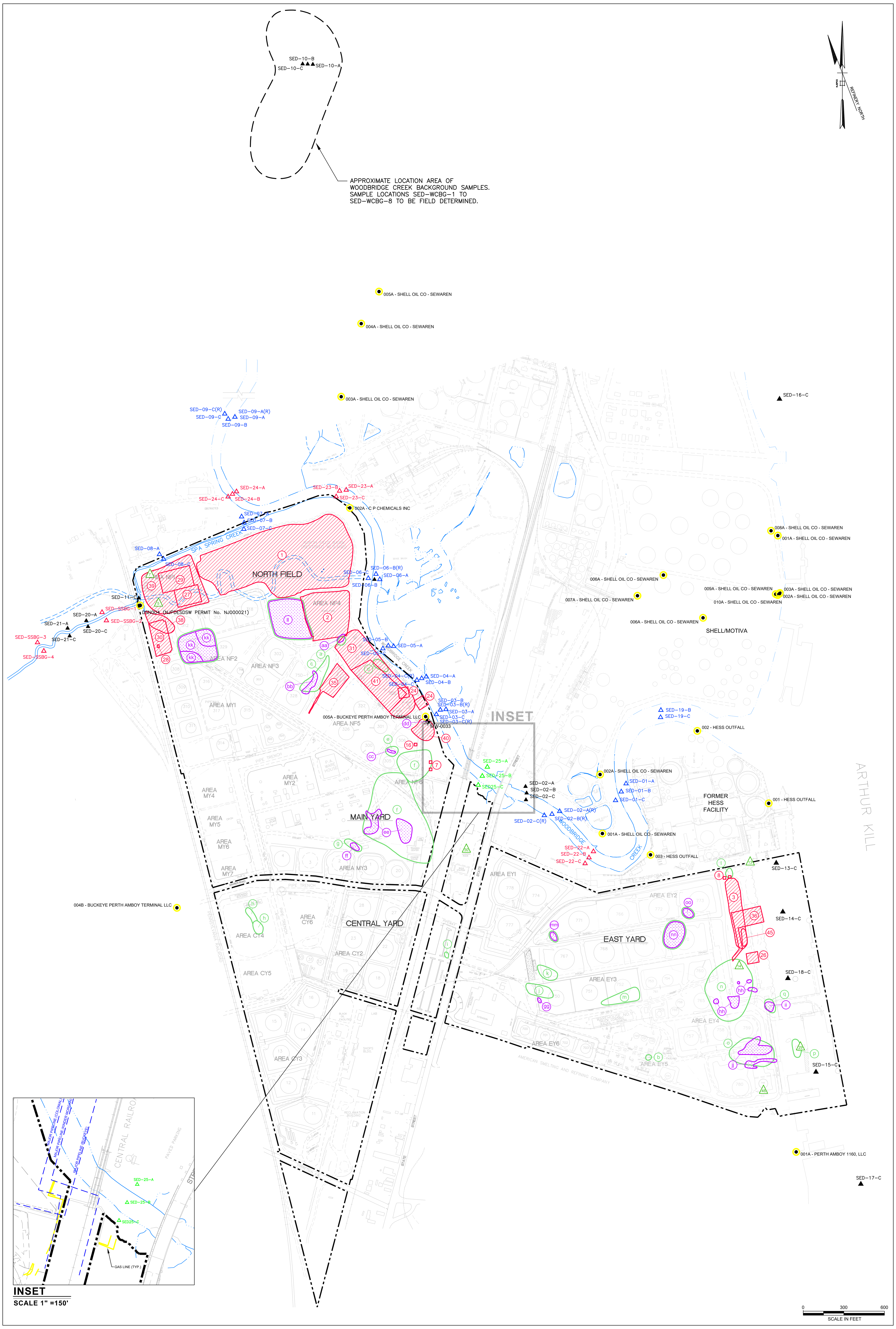
1. THE TOP OF BANK GROUND SURFACE ELEVATIONS ALONG CREEK ARE APPROXIMATE AND BASED ON EXISTING ESRI AERIAL IMAGERY ACESSED 9/18/2019.
2. REFERENCES TO THE BACKGROUND, UPPER, AND LOWER REACHES OF WOODBRIDGE CREEK PERTAIN ONLY TO THE SEDIMENT INVESTIGATION AND ARE NOT OFFICIAL DESIGNATIONS.

PROJECT:	SEDIMENT INVESTIGATION REPORT CHEVRON FACILITY PERTH AMBOY, NEW JERSEY
TITLE:	FACILITY AND AREA OVERVIEW PLAN WITH SEDIMENT SAMPLE LOCATIONS
DRAWN BY:	M. GIAMBATTISTA
CHECKED BY:	W. CORDASCO
APPROVED BY:	R. LIPPENCOTT
DATE:	FEBRUARY 2020
PROJ. NO.:	326731.2020.0000
	FIGURE 2
FILE NO.:	Overview Plan.dwg

TRC
41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

30x42 --- USER: LBochkis --- ATTACHED XREF'S: --- ATTACHED IMAGES: J8A13; J8A14; J8A15; J8C1; J8C2; J8C3; J8C5; J8C6; J8C7;
DRAWING NAME: M:\Cad Files\WORK\890\2019\Bathymetric\Final\rev. 03.20.20\ FIGURE 2A.dwg --- PLOT DATE: May 15, 2020 - 9:16AM --- LAYOUT: FIGURE 2A

Version: 2017-10-21



SOLID WASTE MANAGEMENT UNITS (SWMUs)*

- 1 NORTH FIELD BASIN
- 2 SURGE POND
- 3 EAST YARD BASIN
- 7 TEL BURIAL
- 8 TEL BURIAL
- 16 TEL BURIAL
- 24 TEL WEATHERING AREA
- 26 TEL WEATHERING AREA
- 27 TEL WEATHERING AREA
- 28 REACTOR BURIAL
- 29 FINES TRANSFER AREA
- 30 SHORT TERM STORAGE AREA
- 31 EFFLUENT TREATMENT PLANT
- 35 NO. 4 SEPARATOR
- 36 OIL WATER SEPARATOR NEAR EAST YARD BASIN
- 38 NORTH FIELD SLOP POND
- 39 UNNAMED NORTH FIELD POND
- 40 OLD POND
- 41 DRYING AREA
- 45 IMPOUNDMENT S. OF EAST YARD BASIN

AREAS OF CONCERN (AOCs)*

- 5 PETROLEUM SUBSTANCE NEAR UGST E3
- 7 TARRY MATERIAL AT MW-13
- 13 B-11 OILY FILL AREA
- 14 GWQAP OIL FILL AREA III
- 29 5 BERTH COAL TAR
- 45 TANK BASIN 748
- 50 BULK STATION

FORMER LNAPL AREAS

- a FORMER NF4 LNAPL AREA
- b FORMER AOC 28 LNAPL AREA
- c FORMER NF3 LNAPL AREA
- d FORMER SWMU 41 LNAPL AREA
- e FORMER NF5 LNAPL AREA
- f FORMER AOC 8 NF6 LNAPL AREA
- g FORMER AOC 19 LNAPL AREA
- h FORMER AOC 25 LNAPL AREA - AREA REMEDIATED, CURRENTLY NO LNAPL
- i FORMER STATE STREET PARKING LOT LNAPL AREA - AREA REMEDIATED, CURRENTLY NO LNAPL
- j FORMER SWMU 42 LNAPL AREA
- k FORMER EY1 LNAPL AREA
- l FORMER SWMU 8 LNAPL AREA - AREA REMEDIATED, CURRENTLY NO LNAPL
- m FORMER EY3 LNAPL AREA
- n FORMER EY4b LNAPL AREA
- o FORMER EY4a LNAPL AREA
- p FORMER AOC 29 LNAPL AREA - AREA REMEDIATED, CURRENTLY NO LNAPL
- q FORMER PAOC 15 LNAPL AREA

CURRENT LNAPL AREAS

- aa CURRENT NF4 LNAPL AREA
- bb CURRENT NF3 LNAPL AREA
- cc CURRENT NF5 LNAPL AREA
- dd CURRENT SWMU 40 LNAPL AREAS
- ee CURRENT AOC 8 NF6 LNAPL AREAS
- ff CURRENT AOC 19 LNAPL AREA
- gg CURRENT SWMU 42 LNAPL AREA
- hh CURRENT EY4b LNAPL AREAS
- ii CURRENT PAOC 15 LNAPL AREA
- jj CURRENT EY4a LNAPL AREAS
- kk NF2 LNAPL EXTENT UNCHANGED FROM ORIGINAL EXTENT
- ll SWMU 43 LNAPL EXTENT UNCHANGED FROM ORIGINAL EXTENT
- mm SWMU 10 LNAPL EXTENT UNCHANGED FROM ORIGINAL EXTENT
- nn AOC 31 LNAPL EXTENT UNCHANGED FROM ORIGINAL EXTENT
- oo MW-289 LNAPL EXTENT UNCHANGED FROM ORIGINAL EXTENT

2019 SEDIMENT SAMPLES

Sample ID	Sample Depth	Analysis	Location
SED-WCBG-1[2]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-WCBG-2[2]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-WCBG-3[2]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	2.5-3.0	EPH, VOCs, SVOCs, Metals	
SED-WCBG-4[2]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	1.0-1.5	EPH, VOCs, SVOCs, Metals	
SED-WCBG-5[2]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-WCBG-6[2]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-WCBG-7[2]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-WCBG-8[2]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-01-A	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-01-B	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-01-C	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-02-A(R)	0.5-1.0	EPH and VOCs	Woodbridge Creek
	6.0-6.5	SVOCs, Metals, VOCs	
SED-02-B(R)	0.0-0.5	EPH, SVOCs, Metals	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	3.5-4.0	SVOCs, Metals, VOCs	
SED-02-C(R)	0.0-0.5	EPH, SVOCs, Metals	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-03-A	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	6.0-6.5	EPH, SVOCs, Metals, VOCs	
SED-03-B(R)	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	1.5-2.0	SVOCs, Metals, VOCs	
	4.5-5.0	SVOCs, Metals, VOCs	
SED-03-C(R)	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	1.0-1.5	EPH	
	1.5-2.0	SVOCs, Metals, VOCs	
	2.5-3.0	EPH	
	6.0-6.5	SVOCs, Metals, VOCs	
SED-04-A	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	3.25-3.75	EPH, Metals	
SED-04-B	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-04-C(R)	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	1.5-2.0	SVOCs, Metals, VOCs	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-05-A	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-05-B	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-05-C	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	6.0-6.5	EPH, SVOCs, Metals, VOCs	
SED-06-A	0.0-0.5	EPH and Grain Size	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-06-B(R)	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	4.0-4.5	SVOCs, Metals, VOCs	
SED-06-C	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	4.0-4.5	EPH, SVOCs, Metals, VOCs	
SED-07-A	0.0-0.5	EPH	Spa Spring Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-07-B	0.0-0.5	EPH	Spa Spring Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-07-C	0.0-0.5	EPH and Grain Size	Spa Spring Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-08-A	0.0-0.5	EPH and Grain Size	Spa Spring Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-08-C	0.0-0.5	EPH and Grain Size	Spa Spring Creek
	0.5-1.0	EPH	
	3.0-3.5	EPH, SVOCs, Metals, VOCs	
SED-09-A(R)	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	3.0-3.5	SVOCs, Metals, VOCs	
SED-09-B	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	5.0-5.5	EPH, SVOCs, Metals, VOCs	
SED-09-C(R)	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.75-3.25	EPH	
	4.5-5.0	SVOCs, Metals, VOCs	
SED-10-A	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-10-B	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-10-C	0.0-0.5	EPH	Woodbridge Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-11-C	0.0-0.5	EPH	Spa Spring Creek
	0.5-1.0	EPH	
	2.0-2.5	EPH, SVOCs, Metals, VOCs	
SED-19-B	0.0-0.5	EPH, SVOCs, and Metals	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
SED-19-C	0.0-0.5	EPH, SVOCs, and Metals	Woodbridge Creek
	0.5-1.0	EPH and VOCs	
SED-20-A	2.0-2.5	EPH, SVOCs, Metals, and VOCs	Spa Spring Creek
SED-20-C	2.0-2.5	EPH, SVOCs, Metals, and VOCs	Spa Spring Creek
SED-21-A	2.0-2.5	EPH, SVOCs, Metals, and VOCs	Spa Spring Creek
SED-21-C	2.0-2.5	EPH, SVOCs, Metals, and VOCs	Spa Spring Creek
SED-22-A	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Lower Reach
	0.5-1.0	VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-22-B	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Lower Reach
	0.5-1.0	VOCs	
	9.0-9.5	EPH, VOCs, SVOCs, Metals	
SED-22-C	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Lower Reach
	0.5-1.0	VOCs	
	4.5-5.0	EPH, VOCs, SVOCs, Metals	
SED-23-A	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Upper Reach
	0.5-1.0	VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-23-B	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Upper Reach
	0.5-1.0	VOCs	
	6.5-7.0	EPH, VOCs, SVOCs, Metals	
SED-23-C	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Upper Reach
	0.5-1.0	VOCs	
	5.5-6.0	EPH, VOCs, SVOCs, Metals	
SED-24-A	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Upper Reach
	0.5-1.0	VOCs	
	5.5-6.0	EPH, VOCs, SVOCs, Metals	
SED-24-B	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Upper Reach
	0.5-1.0	VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-24-C	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Upper Reach
	0.5-1.0	VOCs	
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-25-A[3]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Lower Reach
	0.5-1.0	VOCs	
SED-25-B[3]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Lower Reach
	0.5-1.0	VOCs	
SED-25-C[3]	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Woodbridge Creek Lower Reach
	0.5-1.0	VOCs	
SED-SSBG-1	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Spa Spring Creek Background
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-SSBG-2	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Spa Spring Creek Background
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-SSBG-3	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Spa Spring Creek Background
	2.0-2.5	EPH, VOCs, SVOCs, Metals	
SED-SSBG-4	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	Spa Spring Creek Background
	2.0-2.5	EPH, VOCs, SVOCs, Metals	

LEGEND

- FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY
- FORMER SEDIMENT SAMPLE LOCATION (2002 AND 2014)
- 2019 SEDIMENT SAMPLE LOCATION
- FORMER (2002 AND 2014) SEDIMENT SAMPLE IN 2019
- PROPOSED SEDIMENT LOCATION LIMITED TO MANUAL SURFACE SAMPLING (0 - 0.5 FEET) DUE TO BURIED UTILITIES. LOCATION SUBJECT FOR APPROVAL FROM RESPECTIVE PIPELINE COMPANIES
- NJPDES SURFACE WATER DISCHARGE POINT
- CURRENT EXTENT OF LNAPL
- FORMER EXTENT OF LNAPL

NOTES:

1. ALL SAMPLING LOCATIONS SUBJECT TO CHANGE BASED ON FIELD CONDITIONS AND ACCESSIBILITY.
2. ALL LOCATIONS ARE UNDERSTOOD TO BE WITHIN LIMITS OF WATERWAYS - MORE PRECISE LOCATION INFORMATION WILL BE DETAILED IN SUPPLEMENTAL REPORT.
3. INSET NOTE: ALIGNMENT AND DEPTH OF BURIED UTILITIES BELOW CREEK BED IS NOT KNOWN. THERFORE, TRANSECT SED-25 LOCATION WILL BE SUBJECT TO SAFETY RESTRICTIONS IMPOSED BY THE PUBLIC UTILITY.
4. * SELECT SWMUS/AOCS SHOWN IN PROXIMITY TO WATERBODIES
5. SEE FIGURE 2 FOR ACTUAL SAMPLE LOCATIONS

NO.	BY	DATE	REVISION	APP'D
2	MG	3/25/20	UPDATED FOLLOWING 2019 SAMPLING EVENT	WC
1	MG	6/26/19	UPDATED BASED ON USEPA'S MARCH 1, 2019 COMMENTS TO NOVEMBER 2018 SUPPLEMENTAL FIELD SAMPLING AND ANALYSIS PLAN, INCLUDING 5 ADDITIONAL SAMPLE POINTS	WC

PROJECT:
CHEVRON FACILITY
PERTH AMBOY, NEW JERSEY

TITLE:
SEDIMENT SAMPLE LOCATIONS AND SUPPLEMENTAL INFORMATION

DRAWN BY:	M. GIAMBATTISTA
CHECKED BY:	K. LOCKARD
APPROVED BY:	W. CORDASCO
DATE:	JUNE 2019

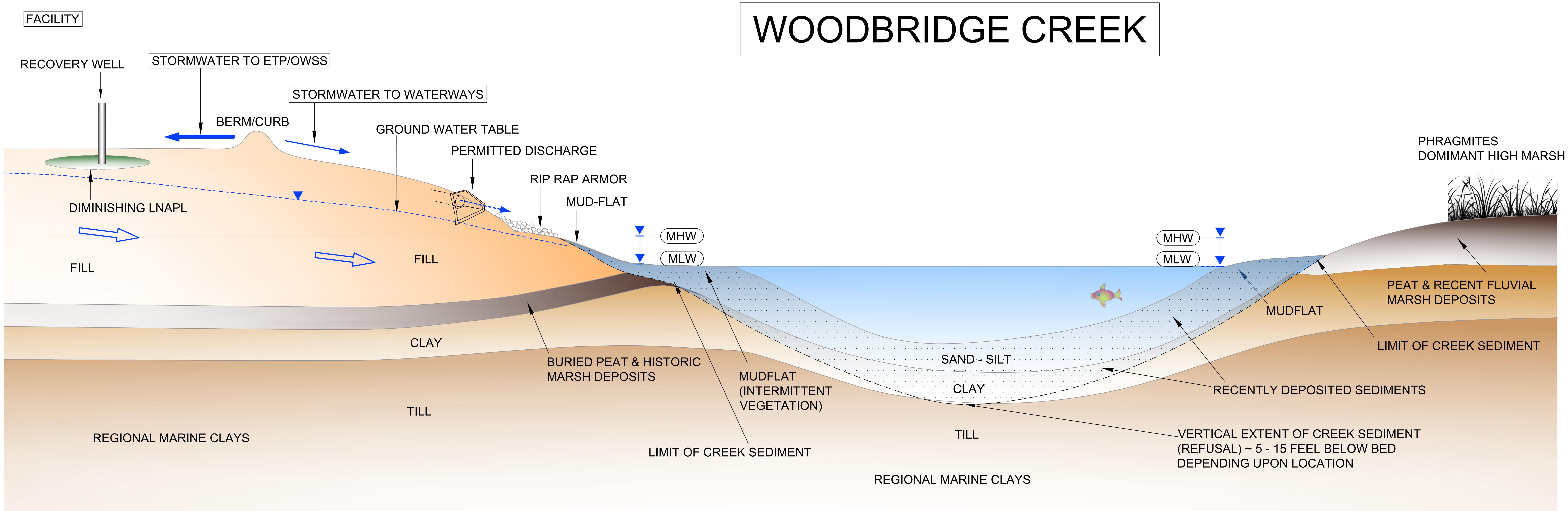
PROJ. NO.: ------

FIGURE 2A

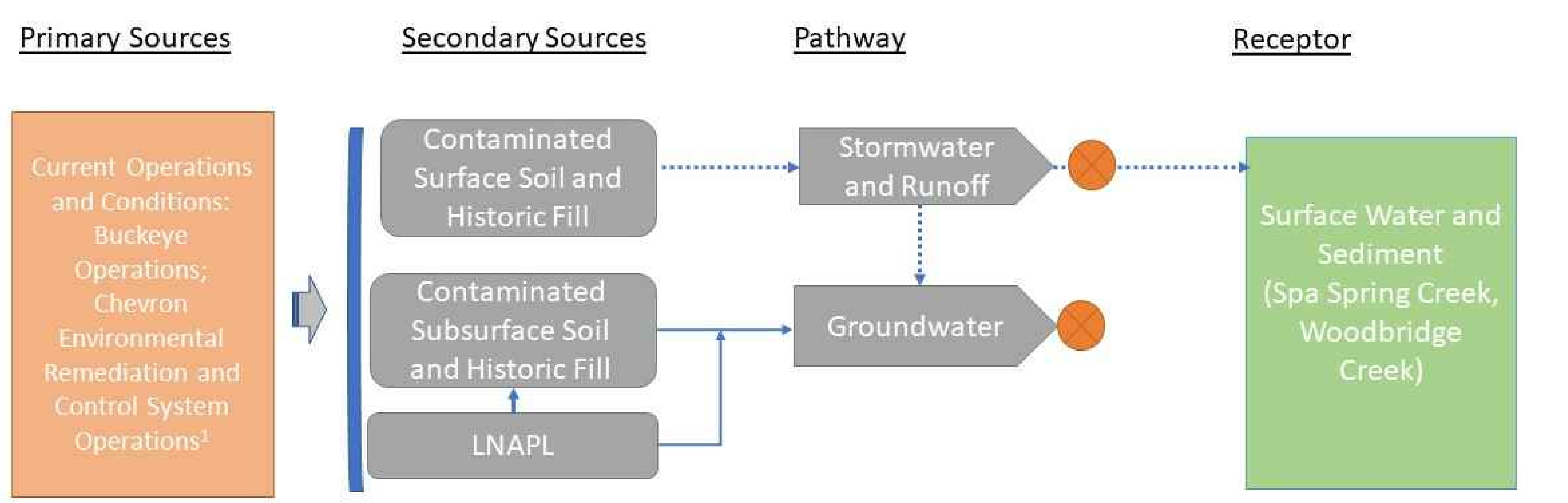
TRC
41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: FIGURE 2A.dwg

WOODBRIDGE CREEK



MIGRATION PATHWAY FLOW DIAGRAM



[1] Stormwater/wastewater control/treatment through berms and diversion to Effluent Control Plant, Oil/Water Separator; Contaminated Soil and Fill controls include containment and capping, in-situ treatment, removal/disposal; LNAPL remediation by removal; Groundwater remediation by containment and in-situ/ex-situ treatment.

Current process/discharge flow

Historical process/discharge flow

LEGEND

ETP/OWSS - Effluent Treatment Plant/Oil-Water Separator

LNAPL - Light, Non-Aqueous Phase Liquid

MHW - limit of Mean High Water

MLW - limit of Mean Low Water

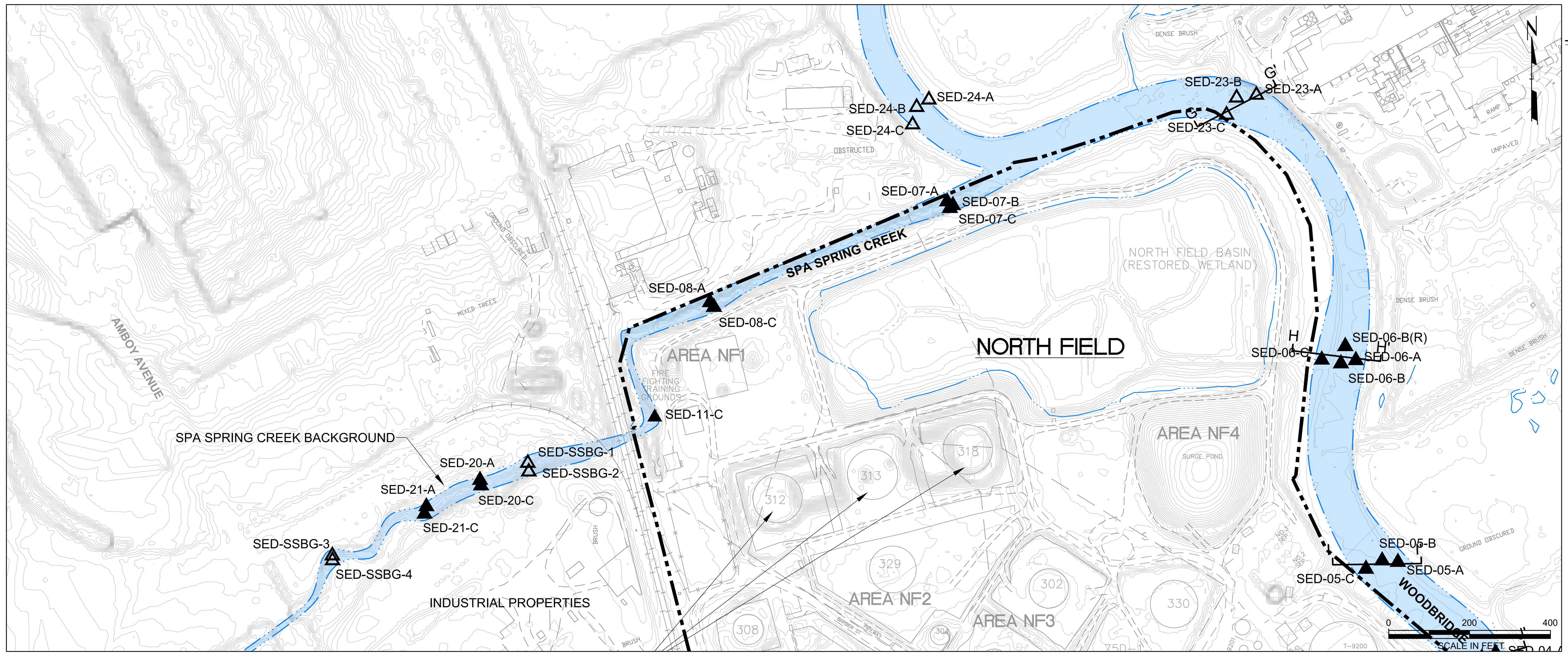
Groundwater Flow Direction

Incomplete Migration Pathway

NOTES:

This graphic provides a generalized representation of stratigraphic and hydrologic conditions associated with Facility-adjacent waterways, and other relevant features.

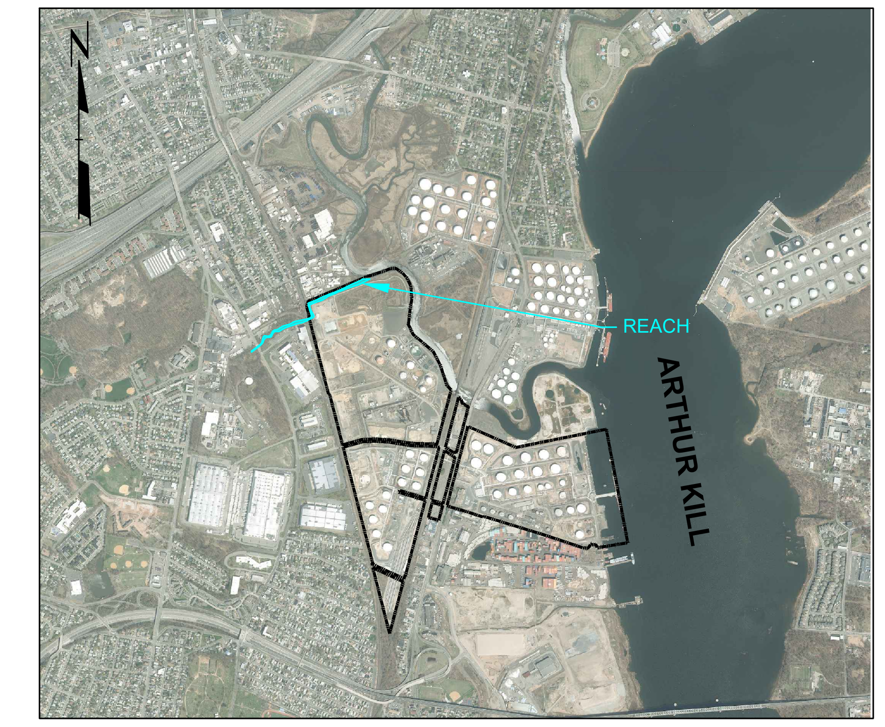
PROJECT:	FORMER CHEVRON FACILITY PERTH AMBOY, NEW JERSEY
TITLE:	CONCEPTUAL SITE MODEL - WOODBRIDGE CREEK
DRAWN BY:	L. BOCHKIS
CHECKED BY:	W. CORDASCO
APPROVED BY:	R. LIPPENCOTT
DATE:	MAY 2020
PROJ NO.:	326731.2020.0000
	FIGURE 2B
TRC	41 Spring Street Suite 102 New Providence, NJ 07974 Phone: 908.988.1700
FILE NO.:	Conceptual Site Model.dwg



FOR REFERNCE SEE OVERVIEW MAP FIGURE ....

LEGEND

- FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY
- WATER FEATURE BOUNDARY (APPROXIMATE)
- △ SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])
- ▲ PREVIOULSY SAMPLED LOCATION REVISITED IN 2019



KEYMAP

SCALE: 1"=2500'

NOTES:

1. TOP OF BANK ELEVATIONS ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).
3. SEDIMENT STRATA INCLUDE MINOR COMPONENTS (E.G. SHELLS; TRACES OF OTHER MATERIAL [SAND, GRAVEL..]) NOT DETAILED HERE.

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-20-A	SED-20-A	0-0.5	2/28/2014	Arsenic	**8.8**
				Benzo(a)anthracene	**0.345**
				Benzo(ghi)perylene	**0.285**
				Chrysene	**0.521**
				Cobalt	12.3
				Dibenz(a,h)anthracene	**0.0731**
				Fluoranthene	**0.909**
				Indeno(1,2,3-cd)pyrene	**0.282**
				Phenanthrene	**0.37**
				Pyrene	**0.813**
				Silver	**1.2**
				Total PAHs	**4.7667**
	SED-20-A/2.0-2.5	2-2.5	10/8/2019	Acenaphthene	***0.2***
				Anthracene	**0.39**
				Benzo(a)pyrene	**0.81**
				Benzo(a)anthracene	**0.79**
				Benzo(ghi)perylene	**0.61**
				Benzo(k)fluoranthene	**0.45**
				Chrysene	**0.85**
				Cobalt	10.8
				Copper	**39.3**
				Dibenz(a,h)anthracene	**0.12**
				Fluoranthene	**2.4**
				Fluorene	***0.19***
				Indeno(1,2,3-cd)pyrene	**0.53**
				Phenanthrene	**1.9**
				Pyrene	**1.9**
				Total PAHs	**12.33**
				Zinc	**221**
SED-20-C	SED-20-C	0-0.5	2/28/2014	Acenaphthene	**0.235**
				Anthracene	**0.277**
				Arsenic	**11.3**
				Benzo(a)pyrene	**0.465**
				Benzo(a)anthracene	**0.475**
				Benzo(ghi)perylene	**0.317**
				bis(2-Ethylhexyl)phthalate	**0.277**
				Chrysene	**0.601**
				Cobalt	14.5
				Dibenz(a,h)anthracene	**0.0816**
				Fluoranthene	**1.24**
				Fluorene	**0.208**
				Indeno(1,2,3-cd)pyrene	**0.32**
				2-Methylnaphthalene	**0.438**
				Naphthalene	**0.268**
				Nickel	**25.1**
				Phenanthrene	**1.15**
				Pyrene	**1.09**
				Silver	**1.2**
				Total PAHs	**7.9876**
				Zinc	**219**
	SED-20-C/2.0-2.5	2-2.5	10/8/2019	Arsenic	**8.75**
				Barium	50.3
				Cobalt	12.1

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-21-A	SED-21-A	0-0.5	2/28/2014	Cobalt	13.4
				Copper	**41.4**
				Silver	**1.1**
				Zinc	**664**
	SED-21-A/2.0-2.5	2-2.5	9/24/2019	Acenaphthene	***0.09*** J
				Anthracene	**0.21**
				Benzo(a)pyrene	**0.47**
				Benzo(a)anthracene	**0.54**
				Benzo(ghi)perylene	**0.33**
				Benzo(k)fluoranthene	**0.3**
				Chrysene	**0.58**
				Dibenz(a,h)anthracene	**0.099** J
				Fluoranthene	**1.4**
				Fluorene	***0.088*** J
				Indeno(1,2,3-cd)pyrene	**0.25**
				Phenanthrene	**0.84**
				Pyrene	**1.2**
				Total PAHs	**7.081**
SED-21-C	SED-21-C	0-0.5	2/28/2014	Acenaphthene	**0.024** J
				bis(2-Ethylhexyl)phthalate	**0.476**
				Cobalt	13.1
				Fluorene	**0.029** J
				Nickel	**27.1**
				Phenanthrene	**0.316**
	SED-21-C/2.0-2.5	2-2.5	9/24/2019	Acenaphthene	***0.15***
				Anthracene	**0.42**
				Benzo(a)pyrene	**1.1**
				Benzo(a)anthracene	**1.1**
				Benzo(ghi)perylene	**0.86**
				Benzo(k)fluoranthene	**0.62**
				bis(2-Ethylhexyl)phthalate	**6.4**
				Chrysene	**1.3**
				Dibenz(a,h)anthracene	**0.26**
				Fluoranthene	**3.1**
				Fluorene	***0.19***
				Indeno(1,2,3-cd)pyrene	**0.75**
				Lead	**184**
				2-Methylnaphthalene	**0.09** J
				Phenanthrene	**1.9**
				Pyrene	**2.6**
				Total PAHs	**15.99**

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-SSBG-1	SED-SSBG-1/0.0-0.5	0-0.5	9/24/2019	Cobalt	11.4
				Lead	**52.2**
				Zinc	**168**
	SED-SSBG-1/2.0-2.5	2-2.5	9/24/2019	Acenaphthylene	**0.06** J
				Anthracene	**0.11**
				Benzo(a)anthracene	**0.29**
				Chrysene	**0.42**
				Cobalt	15.9
				Copper	**105**
				Fluorene	**0.07** J
				Lead	**80.4**
				Nickel	**41.7**
				Pyrene	**0.74**
				Zinc	**297**
SED-SSBG-2	SED-SSBG-2/0.0-0.5	0-0.5	9/24/2019	Acenaphthene	***0.27***
				Acenaphthylene	**0.05** J
				Anthracene	**0.66**
				Arsenic	**9.64** J
				Benzo(a)pyrene	**1.3**
				Benzo(a)anthracene	**1.5**
				Benzo(b)fluoranthene	2.1
				Benzo(ghi)perylene	**0.91**
				Benzo(k)fluoranthene	**0.65**
				Chrysene	**1.7**
				Cobalt	10.9
				Copper	**39.6**
				Dibenz(a,h)anthracene	**0.21**
				Fluoranthene	**4.1**
				Fluorene	***0.37***
				Indeno(1,2,3-cd)pyrene	**0.88**
				Phenanthrene	**2.9**
				Pyrene	**2.8**
				Total PAHs	**20.5**
				Zinc	**193**
	SED-SSBG-2/2.0-2.5 (A)	2-2.5	9/24/2019	Aluminum	####
				Barium	71.2
				Cobalt	10.8
	SED-SSBG-2/2.0-2.5(B)	2-2.5	9/24/2019	Aluminum	####
				Arsenic	**8.44**
				Barium	58.5
				Cobalt	22.5
				Nickel	**31.6**

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-SSBG-3	SED-SSBG-3/0.0-0.5	0-0.5	9/24/2019	Acenaphthene	***0.63***
				Anthracene	**1.1**
				Benzo(a)pyrene	**1.9**
				Benzo(a)anthracene	**2**
				Benzo(b)fluoranthene	2.3
				Benzo(ghi)perylene	**1.3**
				Benzo(k)fluoranthene	**0.86**
				Chrysene	**2.5**
				Copper	**47.2**
				Dibenz(a,h)anthracene	**0.36**
				Fluoranthene	**5.5**
				Fluorene	***0.61***
				Indeno(1,2,3-cd)pyrene	**0.98**
				2-Methylnaphthalene	**0.56**
				Naphthalene	**0.23**
				Phenanthrene	**4.7**
				Pyrene	**4.2**
				Total PAHs	**29.73**
	SED-SSBG-3/2.0-2.5	2-2.5	9/24/2019	Acenaphthene	***0.06*** J
				Acenaphthylene	**0.063** J
				Anthracene	**0.99**
				Benzo(a)pyrene	**1.6**
				Benzo(a)anthracene	**1.9**
				Benzo(b)fluoranthene	2.1
				Benzo(ghi)perylene	**0.94**
				Benzo(k)fluoranthene	**0.9**
				Chrysene	**1.9**
				Cobalt	12.5
				Dibenz(a,h)anthracene	**0.28**
				Fluoranthene	**4.4**
				Fluorene	***0.16***
				Indeno(1,2,3-cd)pyrene	**0.9**
				Phenanthrene	**0.8**
				Pyrene	**3.1**
				Total PAHs	**20.1**
SED-SSBG-4	SED-SSBG-4/0.0-0.5	0-0.5	9/24/2019	Benzo(ghi)perylene	**0.28**
				Cobalt	10.6
				Indeno(1,2,3-cd)pyrene	**0.26**
	SED-SSBG-4/2.0-2.5	2-2.5	9/24/2019	Acenaphthene	***0.03*** J
				Benzo(a)anthracene	**0.4**
				Benzo(ghi)perylene	**0.33**
				Benzo(k)fluoranthene	**0.34**
				Chrysene	**0.52**
				Cobalt	13.7
				Copper	**59.7**
				Dibenz(a,h)anthracene	**0.091** J
				Fluoranthene	**1**
				Fluorene	**0.025** J
				Indeno(1,2,3-cd)pyrene	**0.3**
				Lead	**159**
				Nickel	**29**
				Phenanthrene	**0.41**
				Pyrene	**0.9**
				Total PAHs	**5.394**
				Zinc	**363**

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-20-A	SED-20-A	0-0.5	2/28/2014	EPH, TOTAL FRACTIONATED	83.4
	SED-20-A/2.0-2.5	2-2.5	10/8/2019	EPH, TOTAL FRACTIONATED	46
SED-20-C	SED-20-C	0-0.5	2/28/2014	EPH, TOTAL FRACTIONATED	39.4
	SED-20-C/2.0-2.5	2-2.5	10/8/2019	EPH, TOTAL FRACTIONATED	9.2 J
SED-21-A	SED-21-A	0-0.5	2/28/2014	EPH, TOTAL FRACTIONATED	121
	SED-21-A/2.0-2.5	2-2.5	9/24/2019	EPH, TOTAL FRACTIONATED	49
SED-21-C	SED-21-C	0-0.5	2/28/2014	EPH, TOTAL FRACTIONATED	52.5
	SED-21-C/2.0-2.5	2-2.5	9/24/2019	EPH, TOTAL FRACTIONATED	55
SED-SSBG-1	SED-SSBG-1/0.0-0.5	0-0.5	9/24/2019	EPH, TOTAL FRACTIONATED	19
	SED-SSBG-1/2.0-2.5	2-2.5	9/24/2019	EPH, TOTAL FRACTIONATED	1200
SED-SSBG-2	SED-SSBG-2/0.0-0.5	0-0.5	9/24/2019	EPH, TOTAL FRACTIONATED	83
	SED-SSBG-2/2.0-2.5 (A)	2-2.5	9/24/2019	EPH, TOTAL FRACTIONATED	4.7 J
	SED-SSBG-2/2.0-2.5(B)	2-2.5	9/24/2019	EPH, TOTAL FRACTIONATED	5.6 J
SED-SSBG-3	SED-SSBG-3/0.0-0.5	0-0.5	9/24/2019	EPH, TOTAL FRACTIONATED	96
	SED-SSBG-3/2.0-2.5	2-2.5	9/24/2019	EPH, TOTAL FRACTIONATED	49
SED-SSBG-4	SED-SSBG-4/0.0-0.5	0-0.5	9/24/2019	EPH, TOTAL FRACTIONATED	30
	SED-SSBG-4/2.0-2.5	2-2.5	9/24/2019	EPH, TOTAL FRACTIONATED	340

Parameter	ESC ER-L	ESC ER-M
Acenaphthene	0.016	0.5
Acenaphthylene	0.044	0.64
Aluminum	--	18000
Anthracene	0.085	1.1
Arsenic	8.2	70
Barium	--	48
Benzo(a)pyrene	0.43	1.6
Benzo(a)anthracene	0.261	1.6
Benzo(b)fluoranthene	--	1.8
Benzo(ghi)perylene	0.17	--
Benzo(k)fluoranthene	0.24	--
bis(2-Ethylhexyl)phthalate	0.18216	2.64651
Chrysene	0.384	2.8
Cobalt	--	10
Copper	34	270
Dibenz(a,h)anthracene	0.063	0.26
EPH, TOTAL FRACTIONATED	--	--
Fluoranthene	0.6	5.1
Fluorene	0.019	0.54
Indeno(1,2,3-cd)pyrene	0.2	--
Lead	47	218
2-Methylnaphthalene	0.07	0.67
Naphthalene	0.16	2.1
Nickel	21	52
Phenanthrene	0.24	1.5
Pyrene	0.665	2.6
Silver	1	3.7
Total PAHs	4	45
Zinc	150	410

Note:
ESC = NJDEP Ecological Screening Criteria, March 2009
ESC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)
ESC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
Bold indicates concentrations above the ESC ER-L
Underline indicates concentrations above the ESC ER-M
J = Estimated value below sample reporting limit
Values in italics indicate MDL above applicable criterion.
All concentrations are in milligrams per kilogram (mg/kg).
Only constituents with concentrations above the referenced standard or criteria are presented.

PROJECT: **SEDIMENT INVESTIGATION REPORT**
CHEVRON FACILITY
PERTH AMBOY, NEW JERSEY

TITLE: **SEDIMENT ANALYTICAL RESULTS**
SPA SPRING CREEK - BACKGROUND REACH

DRAWN BY:	M. GIAMBATTISTA	PROJ. NO.:	326731.2020.0000
CHECKED BY:	W. CORDASCO		**FIGURE 3**
APPROVED BY:	R. LIPPENCOTT		
DATE:	FEBRUARY 2020		

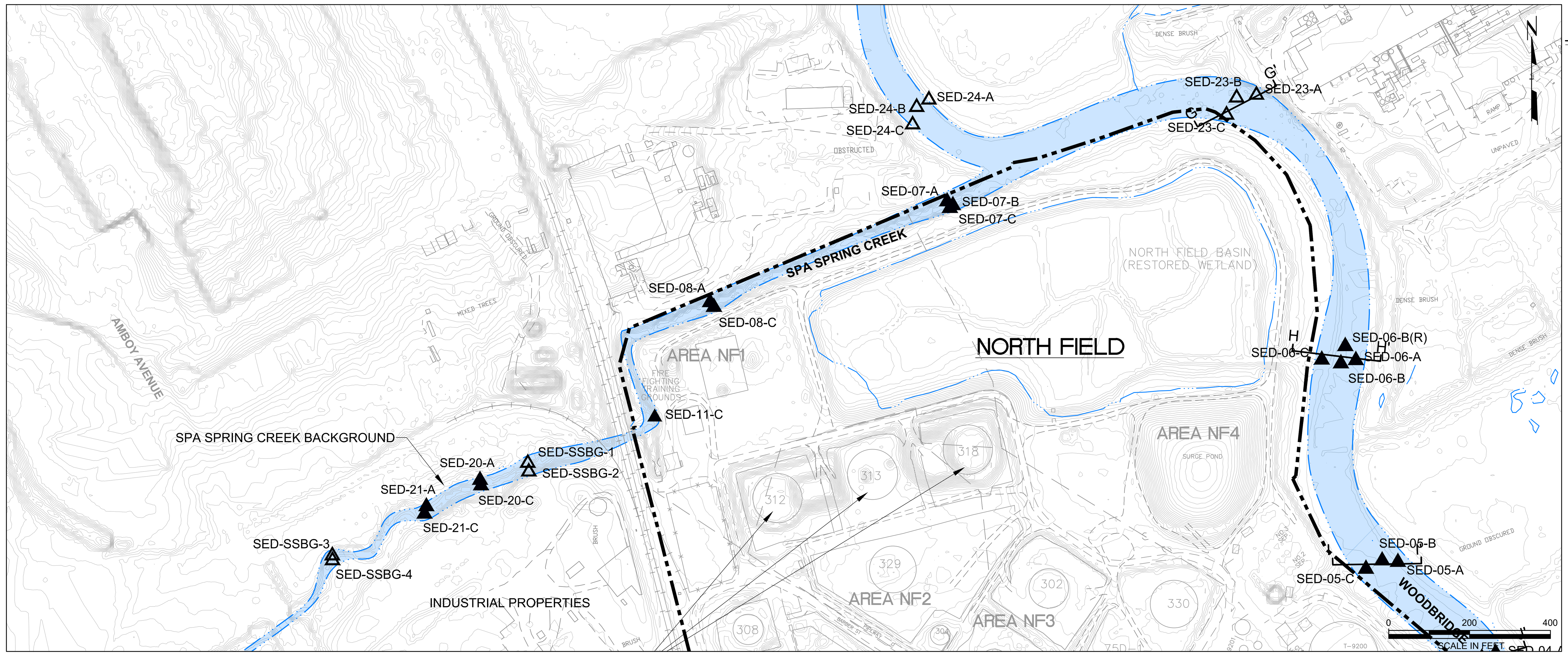
TRC

41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: Spa SpringBathymetricTransect figures_DATA.dwg

DRAWING NAME: M:\Cad Files\WORK\690\2019\Bathymetric\Final\ Spa SpringBathymetricTransect figures_DATA.dwg --- PLOT DATE: May 15, 2020 - 9:34AM --- LAYOUT: BACKGROUND

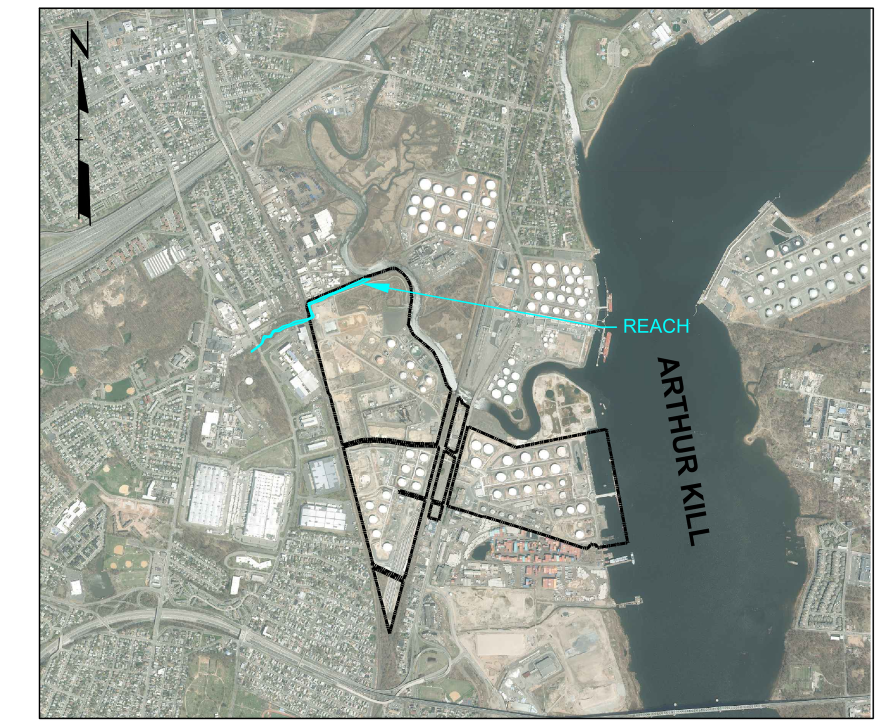
Version: 2017-10-21



FOR REFERNCE SEE OVERVIEW MAP FIGURE ....

LEGEND

- FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY
- WATER FEATURE BOUNDARY (APPROXIMATE)
- △ SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])
- ▲ PREVIOULSY SAMPLED LOCATION REVISITED IN 2019



KEYMAP

SCALE: 1"=2500'

NOTES:

1. TOP OF BANK ELEVATIONS ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).
3. SEDIMENT STRATA INCLUDE MINOR COMPONENTS (E.G. SHELLS; TRACES OF OTHER MATERIAL [SAND, GRAVEL..]) NOT DETAILED HERE.

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-07-A	SED-07-A/0-6	0-0.5	12/20/2002	Acenaphthene	**0.017** J
				Acenaphthylene	**0.083**
				Anthracene	**0.13**
				Benzo(a)pyrene	**0.45**
				Benzo(a)anthracene	**0.29**
				Benzo(ghi)perylene	**0.74**
				bis(2-Ethylhexyl)phthalate	***0.5*** J
				Chrysene	**0.39**
				Dibenz(a,h)anthracene	**0.15**
				Fluorene	**0.031**
				Indeno(1,2,3-cd)pyrene	**0.37**
				Phenanthrene	**0.31**
				Total PAHs	**4.891**
SED-08-C	SED-08-C/0-6	0-0.5	12/20/2002	Benzo(ghi)perylene	**0.23**
				bis(2-Ethylhexyl)phthalate	***0.86*** J

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-07-A	SED-07-A/0-6	0-0.5	12/20/2002	Aluminum	24300
				Arsenic	**164**
				Barium	165
				Cadmium	**2.5** J
				Chromium	**133**
				Cobalt	17.7
				Copper	**494**
				Lead	**656**
				Mercury	**2.6**
				Nickel	**85.1**
				Selenium	13
				Silver	**2.1** J
				Vanadium	109
				Zinc	**573**
	SED-07-A/2.0-2.5	2-2.5	10/16/2019	Aluminum	24300
				Barium	54.6
				Cobalt	13.3
				Manganese	520
				Nickel	**32.4**
				Silver	**1.66**
SED-07-B	SED-07-B/0-6	0-0.5	12/20/2002	Aluminum	19900
				Arsenic	**10.8**
				Barium	56.9 J
				Cobalt	10.4 J
				Copper	**69.5**
				Manganese	272
				Nickel	**33.7** J

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-07-C	SED-07-C/0-6	0-0.5	12/20/2002	Arsenic	**9.1**
SED-08-A	SED-08-A/0-6	0-0.5	12/20/2002	Barium	54.7 J
				Cadmium	**1.3** J
				Cobalt	18.8 J
				Manganese	431
				Nickel	**25.4** J
	SED-08-A/2.0-2.5(A)	2-2.5	10/14/2019	Barium	207
	SED-08-A/2.0-2.5(B)	2-2.5	10/14/2019	Aluminum	18300
				Barium	265
SED-08-C	SED-08-C/0-6	0-0.5	12/20/2002	Arsenic	**10.4**
				Barium	76.7
				Cobalt	36.7
				Manganese	1230
				Nickel	**82.4**
				Zinc	**1140**
	SED-08-C/3.0-3.5	3-3.5	10/14/2019	Aluminum	21200
				Arsenic	**34.6**
				Barium	378
				Manganese	276
SED-11-C	SED-11-C/0-6	0-0.5	12/20/2002	Aluminum	27100
				Arsenic	**10**
				Barium	71.1
				Cadmium	**1.6** J
				Cobalt	18.8
				Manganese	423
				Nickel	**32.9**
	SED-11-C/2.0-2.5	2-2.5	10/8/2019	Aluminum	22900
				Arsenic	**8.95**
				Barium	58.5
				Cobalt	13.9
				Nickel	**23.5**

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-07-B	SED-07-B/0.0-0.5	0-0.5	10/14/2019	EPH, TOTAL FRACTIONATED	35
	SED-07-B/0.5-1.0	0.5-1	10/14/2019	EPH, TOTAL FRACTIONATED	43
SED-07-C	SED-07-C/0.0-0.5	0-0.5	10/16/2019	EPH, TOTAL FRACTIONATED	250
	SED-07-C/0.5-1.0	0.5-1	10/16/2019	EPH, TOTAL FRACTIONATED	83
	SED-07-C/2.0-2.5	2-2.5	10/16/2019	EPH, TOTAL FRACTIONATED	3.7 J
SED-08-A	SED-08-A/0.0-0.5	0-0.5	10/14/2019	EPH, TOTAL FRACTIONATED	6.6 J
SED-08-C	SED-08-C/0.0-0.5	0-0.5	10/14/2019	EPH, TOTAL FRACTIONATED	51 J
	SED-08-C/3.0-3.5	3-3.5	10/14/2019	EPH, TOTAL FRACTIONATED	32 J
SED-11-C	SED-11-C/0.0-0.5	0-0.5	10/8/2019	EPH, TOTAL FRACTIONATED	5.7 J
	SED-11-C/0.5-1.0	0.5-1	10/8/2019	EPH, TOTAL FRACTIONATED	12 J
	SED-11-C/2.0-2.5	2-2.5	10/8/2019	EPH, TOTAL FRACTIONATED	13 J

Parameter	ESC ER-L	ESC ER-M
Acenaphthene	0.016	0.5
Acenaphthylene	0.044	0.64
Anthracene	0.085	1.1
Benzo(a)pyrene	0.43	1.6
Benzo(a)anthracene	0.261	1.6
Benzo(ghi)perylene	0.17	--
bis(2-Ethylhexyl)phthalate	0.18216	2.64651
Chrysene	0.384	2.8
Dibenz(a,h)anthracene	0.063	0.26
Fluorene	0.019	0.54
Indeno(1,2,3-cd)pyrene	0.2	--
Phenanthrene	0.24	1.5
Total PAHs	4	45
EPH, TOTAL FRACTIONATED	--	--
Aluminum	--	18000
Arsenic	8.2	70
Barium	--	48
Cadmium	1.2	9.6
Chromium	81	370
Cobalt	--	10
Copper	34	270
Lead	47	218
Manganese	--	260
Mercury	0.15	0.71
Nickel	21	52
Selenium	--	1
Silver	1	3.7
Vanadium	--	57
Zinc	150	410

Note:

ESC = NJDEP Ecological Screening Criteria, March 2009

ESC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)

ESC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
Bold indicates concentrations above the ESC ER-L
Underline indicates concentrations above the ESC ER-M
J = Estimated value below sample reporting limit
Values in italics indicate MDL above applicable criterion.

All concentrations are in milligrams per kilogram (mg/kg).

Only constituents with concentrations above the referenced standard or criteria are presented.

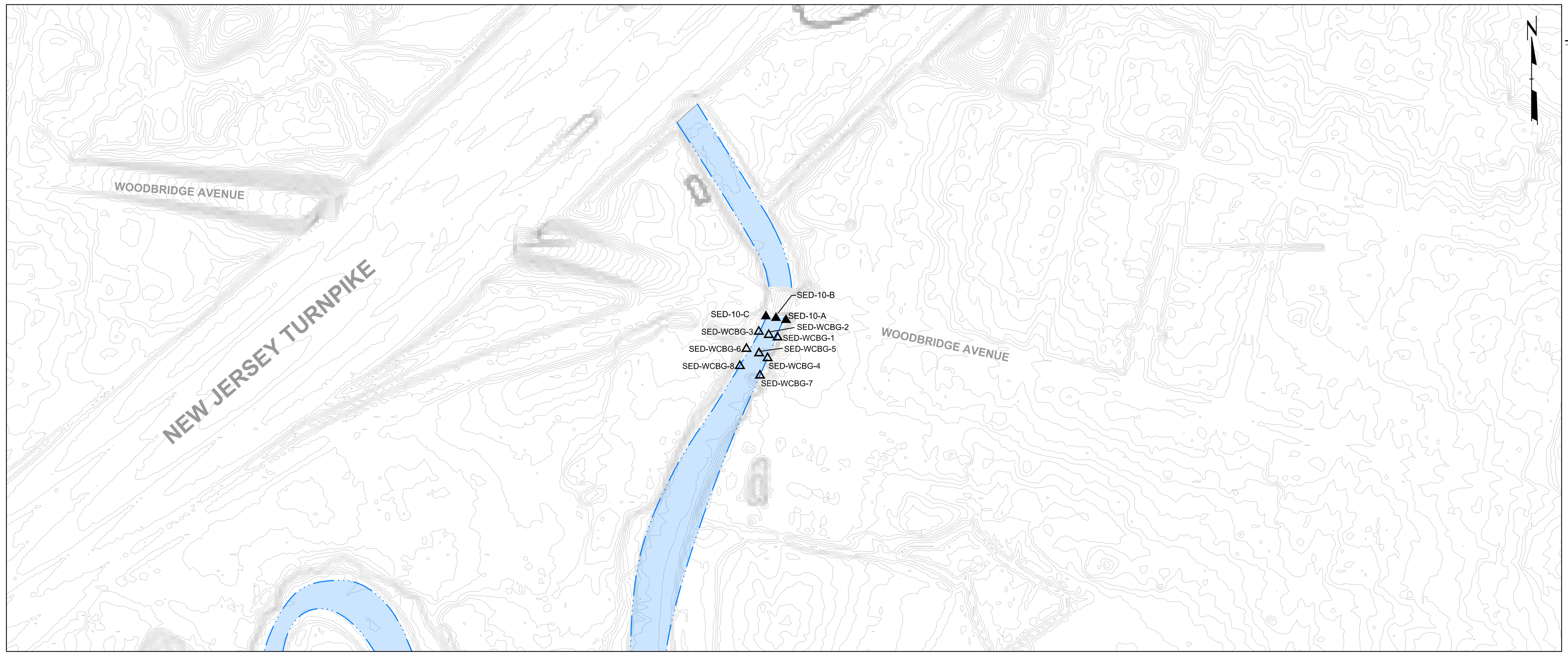
PROJECT:
SEDIMENT INVESTIGATION REPORT
CHEVRON FACILITY
PERTH AMBOY, NEW JERSEY

TITLE:
SEDIMENT ANALYTICAL RESULTS
SPA SPRING CREEK - SITE REACH

DRAWN BY:	M. GIAMBATTISTA	PROJ. NO.:	326731.2020.0000
CHECKED BY:	W. CORDASCO		**FIGURE 4**
APPROVED BY:	R. LIPPENCOTT		
DATE:	FEBRUARY 2020		

TRC
41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: Spa SpringBathymetricTransect figures_DATA.dwg



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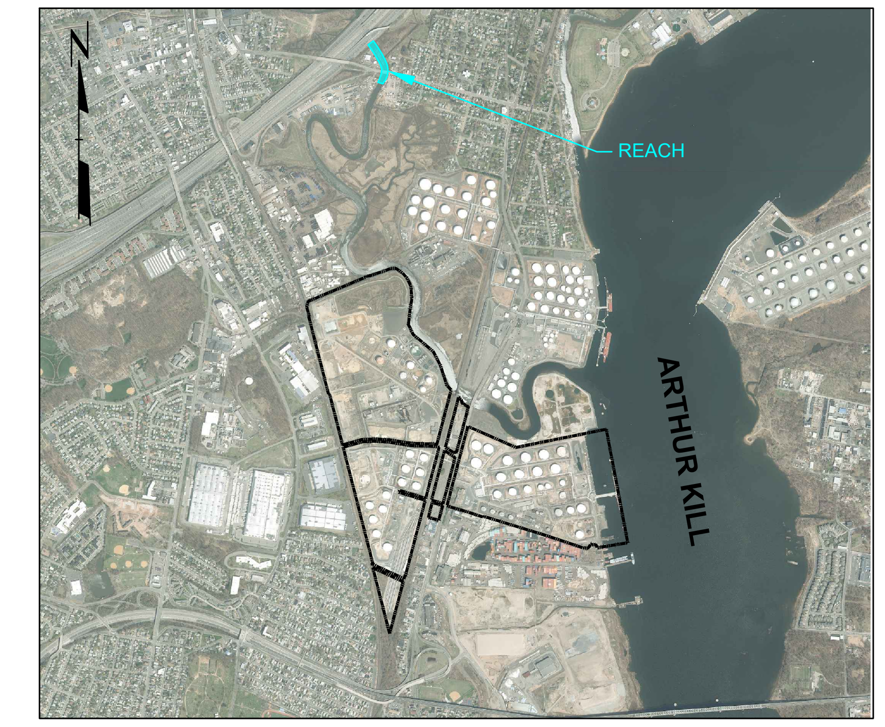
SCALE IN FEET

LEGEND

- FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY
- WATER FEATURE BOUNDARY (APPROXIMATE)
- △ SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])
- ▲ PREVIOLSY SAMPLED LOCATION REVISITED IN 2019



KEYMAP
SCALE: 1"=2500'

NOTES:

1. TOP OF BANK ELEVATIONS ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-10-A	SED-10-A/0-6	0-0.5	12/19/2002	bis(2-Ethylhexyl)phthalate	0.46
				Copper	69.6
				Lead	52.5
				Nickel	33.7
				Zinc	457
	SED-10-A/2.0-2.5	2-2.5	10/15/2019	Barium	79.7
				bis(2-Ethylhexyl)phthalate	0.23
SED-10-B	SED-10-B/0-6	0-0.5	12/19/2002	Acenaphthene	0.052
				Anthracene	0.19
				Benzo(a)pyrene	0.65
				Benzo(a)anthracene	0.63
				Benzo(ghi)perylene	0.21
				Benzo(k)fluoranthene	0.34
				bis(2-Ethylhexyl)phthalate	1 J
				Chrysene	1
				Copper	47.3
				Dibenz(a,h)anthracene	0.073
				Fluoranthene	1.1
				Fluorene	0.074
				Indeno(1,2,3-cd)pyrene	0.22
				2-Methylnaphthalene	0.22
				Naphthalene	0.22
				Nickel	31.2
				Phenanthrene	0.77
				Pyrene	1.4
				Total PAHs	8.276
				Vanadium	75.2
				Zinc	184
	SED-10-B/2.0-2.5	2-2.5	10/15/2019	Barium	147
				Butyl benzyl phthalate	0.42
				Cobalt	11.9
				Copper	99.6
				Lead	111
				Nickel	30.3
				Zinc	936
SED-10-C	SED-10-C/0-6	0-0.5	12/19/2002	Acenaphthene	0.017
				bis(2-Ethylhexyl)phthalate	5.2
				Copper	85.7
				Lead	110
				Nickel	28.8
				Zinc	448

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-WCBG-1	SED-WCBG-1/0.0-0.5	0-0.5	10/15/2019	Acenaphthene	0.56
				Acenaphthylene	0.51
				Anthracene	5.1
				Barium	52.3
				Benzo(a)pyrene	14
				Benzo(a)anthracene	16
				Benzo(b)fluoranthene	18
				Benzo(ghi)perylene	8.5
				Benzo(k)fluoranthene	6.3
				Chrysene	14
				Cobalt	11.7
				Copper	76.9
				Dibenz(a,h)anthracene	2
				Fluoranthene	32
				Fluorene	1.4
				Indeno(1,2,3-cd)pyrene	6.6
				Lead	66.1
				Manganese	269
				Nickel	21.6
				Phenanthrene	8.2
				Pyrene	23
				Silver	1.14 J
				Total PAHs	156.4
				Zinc	210
	SED-WCBG-1/2.0-2.5	2-2.5	10/15/2019	Aluminum	18300
				Barium	72.8
				Benzo(a)pyrene	0.63
				Benzo(a)anthracene	0.4
				Benzo(ghi)perylene	0.52
				Chrysene	0.68
				Cobalt	10.6
				Dibenz(a,h)anthracene	0.085
				Manganese	422
				Mercury	0.193 J
				Nickel	21.6
				Silver	1.04 J
SED-WCBG-2	SED-WCBG-2/0.0-0.5	0-0.5	10/18/2019	Manganese	275
	SED-WCBG-2/2.0-2.5	2-2.5	10/18/2019	Barium	72.2

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-WCBG-3	SED-WCBG-3/0.0-0.5	0-0.5	10/15/2019	Anthracene	0.12 J
				Arsenic	24.8
				Barium	56.2
				Benzo(a)pyrene	0.9
				Benzo(a)anthracene	0.65
				Benzo(ghi)perylene	0.74
				Benzo(k)fluoranthene	0.54
				bis(2-Ethylhexyl)phthalate	4.1
				Cadmium	1.33
				Chrysene	0.55
				Cobalt	45
				Copper	2090
				Dibenz(a,h)anthracene	0.15
				Fluoranthene	1.5
				Indeno(1,2,3-cd)pyrene	0.62
				Lead	328
				Mercury	0.9
				Nickel	194
				Pyrene	1.8
				Silver	2.93
				Total PAHs	9.088
				Zinc	1400
	SED-WCBG-3/2.5-3.0	2.5-3	10/15/2019	Acenaphthene	0.24
				Aluminum	20900
				Anthracene	1.5
				Arsenic	40.5
				Barium	111
				Benzo(a)pyrene	1.7
				Benzo(a)anthracene	2.4
				Benzo(b)fluoranthene	2
				Benzo(ghi)perylene	1.1
				Benzo(k)fluoranthene	0.82
				bis(2-Ethylhexyl)phthalate	2.7
				Cadmium	9.98
				Chrysene	2.1
				Cobalt	18
				Copper	440
				Dibenz(a,h)anthracene	0.28
				Fluoranthene	4.9
				Fluorene	0.19 J
				Indeno(1,2,3-cd)pyrene	0.81
				Lead	272
				Mercury	0.826
				Nickel	151
				Phenanthrene	0.44
				Pyrene	3.7
				Selenium	8.13 J
				Silver	2.22 J
				Total PAHs	22.24
				Vanadium	78.6
				Zinc	447

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-WCBG-4	SED-WCBG-4/0.0-0.5	0-0.5	10/16/2019	Arsenic	10
				Cadmium	1.41
				Cobalt	17.4
				Copper	144
				Lead	164
				Nickel	45.7
				Zinc	544
	SED-WCBG-4/1.0-1.5	1-1.5	10/16/2019	Arsenic	9.72 J
				Copper	66.7
				Lead	71.7
				Nickel	27.6
				Zinc	171
SED-WCBG-5	SED-WCBG-5/0.0-0.5	0-0.5	10/18/2019	Arsenic	14.2
				Cobalt	10.3
				Copper	62.9
				Nickel	29.5
				Zinc	239
	SED-WCBG-5/2.0-2.5(A)	2-2.5	10/18/2019	Barium	65.9
				Copper	83.2
				Lead	49.4
				Manganese	1060
				Zinc	698
	SED-WCBG-5/2.0-2.5(B)	2-2.5	10/18/2019	Manganese	454
SED-WCBG-6	SED-WCBG-6/0.0-0.5	0-0.5	10/16/2019	Anthracene	0.2 J
				Arsenic	30.4
				Barium	101
				Benzo(a)pyrene	1
				Benzo(a)anthracene	1
				Benzo(ghi)perylene	1.2
				Benzo(k)fluoranthene	0.34
				bis(2-Ethylhexyl)phthalate	4.1
				Cadmium	4.55
				Chrysene	0.71
				Copper	340
				Dibenz(a,h)anthracene	0.28
				Fluoranthene	0.82
				Indeno(1,2,3-cd)pyrene	0.45
				Lead	209
				Mercury	1.19
				Nickel	56.1
				Phenanthrene	0.44
				Pyrene	1.9
				Silver	1.2 J
				Total PAHs	9.54
				Vanadium	66.4
				Zinc	394
	SED-WCBG-6/2.0-2.5	2-2.5	10/16/2019	Anthracene	0.18 J
				Arsenic	14.2
				Benzo(a)anthracene	0.45 J
				Cadmium	1.34
				Chrysene	0.61
				Copper	43.6
				Fluoranthene	1
				Indeno(1,2,3-cd)pyrene	0.26 J
				Lead	64.4
				Mercury	0.216
				Pyrene	1
				Total PAHs	4.69

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-WCBG-7	SED-WCBG-7/0.0-0.5	0-0.5	10/16/2019	Mercury	0.236
SED-WCBG-8	SED-WCBG-8/0.0-0.5	0-0.5	10/18/2019	Arsenic	18.4
				Benzo(a)anthracene	0.32
				Benzo(ghi)perylene	0.4
				bis(2-Ethylhexyl)phthalate	1.1
				Cadmium	2.32
				Cobalt	12.7
				Copper	81.3
				Dibenz(a,h)anthracene	0.094
				Lead	116
				Mercury	0.812
				Nickel	46.1
				Selenium	2.07 J
				Zinc	316
	SED-WCBG-8/2.0-2.5	2-2.5	10/18/2019	Acenaphthene	0.043
				Anthracene	0.11
				Arsenic	12.6
				Benzo(a)anthracene	0.43
				Benzo(ghi)perylene	0.27
				bis(2-Ethylhexyl)phthalate	0.23 J
				Chrysene	0.41
				Copper	40.6
				Dibenz(a,h)anthracene	0.068
				Fluoranthene	0.68
				Fluorene	0.078
				Indeno(1,2,3-cd)pyrene	0.21
				Lead	52.4
				Phenanthrene	0.56
				Pyrene	0.86
				Total PAHs	4.84

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-10-A	SED-10-A/0.0-0.5	0-0.5	10/15/2019	EPH, TOTAL FRACTIONATED	2900
	SED-10-A/0.5-1.0	0.5-1	10/15/2019	EPH, TOTAL FRACTIONATED	260
	SED-10-A/2.0-2.5	2-2.5	10/15/2019	EPH, TOTAL FRACTIONATED	3.5 J
SED-10-C	SED-10-C/0.0-0.5	0-0.5	10/15/2019	EPH, TOTAL FRACTIONATED	35
	SED-10-C/0.5-1.0	0.5-1	10/15/2019	EPH, TOTAL FRACTIONATED	120
	SED-10-C/2.0-2.5	2-2.5	10/15/2019	EPH, TOTAL FRACTIONATED	4.7 J
SED-WCBG-1	SED-WCBG-1/0.0-0.5	0-0.5	10/15/2019	EPH, TOTAL FRACTIONATED	3400
	SED-WCBG-1/0.5-1.0	0.5-1	10/15/2019	EPH, TOTAL FRACTIONATED	1000
	SED-WCBG-1/2.0-2.5	2-2.5	10/15/2019	EPH, TOTAL FRACTIONATED	280
SED-WCBG-2	SED-WCBG-2/0.5-1.0	0.5-1	10/18/2019	EPH, TOTAL FRACTIONATED	4.4 J
SED-WCBG-3	SED-WCBG-3/0.0-0.5	0-0.5	10/15/2019	EPH, TOTAL FRACTIONATED	1400
	SED-WCBG-3/0.5-1.0(A)	0.5-1	10/15/2019	EPH, TOTAL FRACTIONATED	890
	SED-WCBG-3/0.5-1.0(B)	0.5-1	10/15/2019	EPH, TOTAL FRACTIONATED	1000
	SED-WCBG-3/2.5-3.0	2.5-3	10/15/2019	EPH, TOTAL FRACTIONATED	1600
SED-WCBG-4	SED-WCBG-4/0.0-0.5	0-0.5	10/16/2019	EPH, TOTAL FRACTIONATED	16
	SED-WCBG-4/0.5-1.0	0.5-1	10/16/2019	EPH, TOTAL FRACTIONATED	34
	SED-WCBG-4/1.0-1.5	1-1.5	10/16/2019	EPH, TOTAL FRACTIONATED	230
SED-WCBG-5	SED-WCBG-5/0.0-0.5	0-0.5	10/18/2019	EPH, TOTAL FRACTIONATED	23
	SED-WCBG-5/0.5-1.0	0.5-1	10/18/2019	EPH, TOTAL FRACTIONATED	8.6 J
	SED-WCBG-5/2.0-2.5(A)	2-2.5	10/18/2019	EPH, TOTAL FRACTIONATED	3.8 J
SED-WCBG-6	SED-WCBG-6/0.0-0.5	0-0.5	10/16/2019	EPH, TOTAL FRACTIONATED	2000
	SED-WCBG-6/0.5-1.0	0.5-1	10/16/2019	EPH, TOTAL FRACTIONATED	2400
	SED-WCBG-6/2.0-2.5	2-2.5	10/16/2019	EPH, TOTAL FRACTIONATED	1400
SED-WCBG-7	SED-WCBG-7/0.0-0.5	0-0.5	10/16/2019	EPH, TOTAL FRACTIONATED	5.9 J
	SED-WCBG-7/0.5-1.0(B)	0.5-1	10/16/2019	EPH, TOTAL FRACTIONATED	6.7 J
SED-WCBG-8	SED-WCBG-8/0.0-0.5	0-0.5	10/18/2019	EPH, TOTAL FRACTIONATED	1900
	SED-WCBG-8/0.5-1.0	0.5-1	10/18/2019	EPH, TOTAL FRACTIONATED	1100
	SED-WCBG-8/2.0-2.5	2-2.5	10/18/2019	EPH, TOTAL FRACTIONATED	160

Parameter	ESC ER-L	ESC ER-M
Acenaphthene	0.016	0.5
Acenaphthylene	0.044	0.64
Aluminum	--	18000
Anthracene	0.085	1.1
Arsenic	8.2	70
Barium	--	48
Benzo(a)pyrene	0.43	1.6
Benzo(a)anthracene	0.261	1.6
Benzo(b)fluoranthene	--	1.8
Benzo(ghi)perylene	0.17	--
Benzo(k)fluoranthene	0.24	--
bis(2-Ethylhexyl)phthalate	0.18216	2.64651
Butyl benzyl phthalate	--	0.063
Cadmium	1.2	9.6
Chrysene	0.384	2.8
Cobalt	--	10
Copper	34	270
Dibenz(a,h)anthracene	0.063	0.26
EPH, TOTAL FRACTIONATED	--	--
Fluoranthene	0.6	5.1
Fluorene	0.019	0.54
Indeno(1,2,3-cd)pyrene	0.2	--
Lead	47	218
Manganese	--	260
Mercury	0.15	0.71
2-Methylnaphthalene	0.07	0.67
Naphthalene	0.16	2.1
Nickel	21	52
Phenanthrene	0.24	1.5
Pyrene	0.665	2.6
Selenium	--	1
Silver	1	3.7
Total PAHs	4	45
Vanadium	--	57
Zinc	150	410

Note:
ESC = NJDEP Ecological Screening Criteria, March 2009
ESC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)
ESC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
Bold indicates concentrations above the ESC ER-L
Underline indicates concentrations above the ESC ER-M
ND = Not Detected
NA = Not Analyzed
J = Estimated value below sample reporting limit
MDL = Method Detection Limit
U = Compound not detected above MDL
Values in italics indicate MDL above applicable criterion.
All concentrations are in milligrams per kilogram (mg/kg).
Only constituents with concentrations above the referenced standard or criteria are presented.

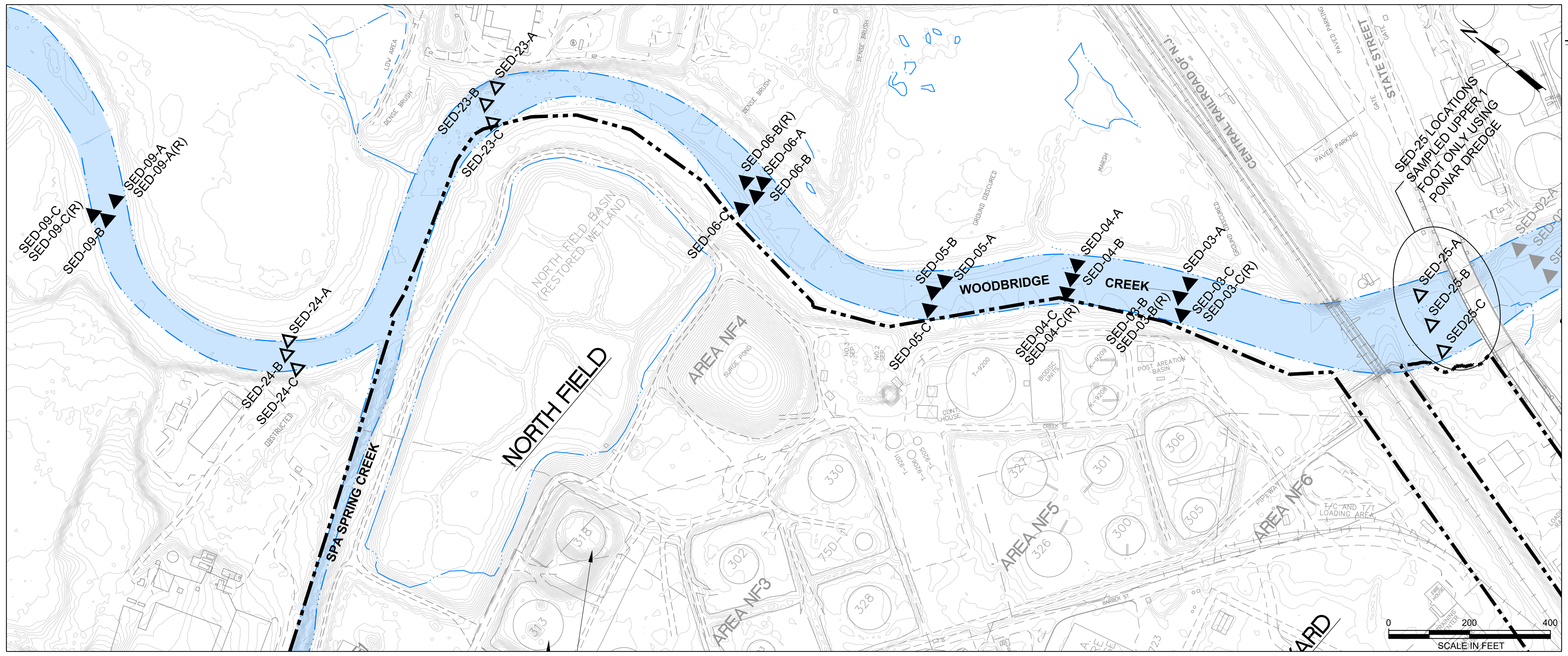
PROJECT:
SEDIMENT INVESTIGATION REPORT
CHEVRON FACILITY
PERTH AMBOY, NEW JERSEY

TITLE:
SEDIMENT ANALYTICAL RESULTS
WOODBRIDGE CREEK - BACKGROUND

DRAWN BY:	M. GIAMBATTISTA	PROJ NO.:	326731.2020.0000
CHECKED BY:	W. CORDASCO	FIGURE 5	
APPROVED BY:	R. LIPPENCOTT		
DATE:	FEBRUARY 2020		

TRC
41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: BathymetricTransect figures_DATA.dwg



FOR REFERNCE SEE OVERVIEW MAP FIGURE ....

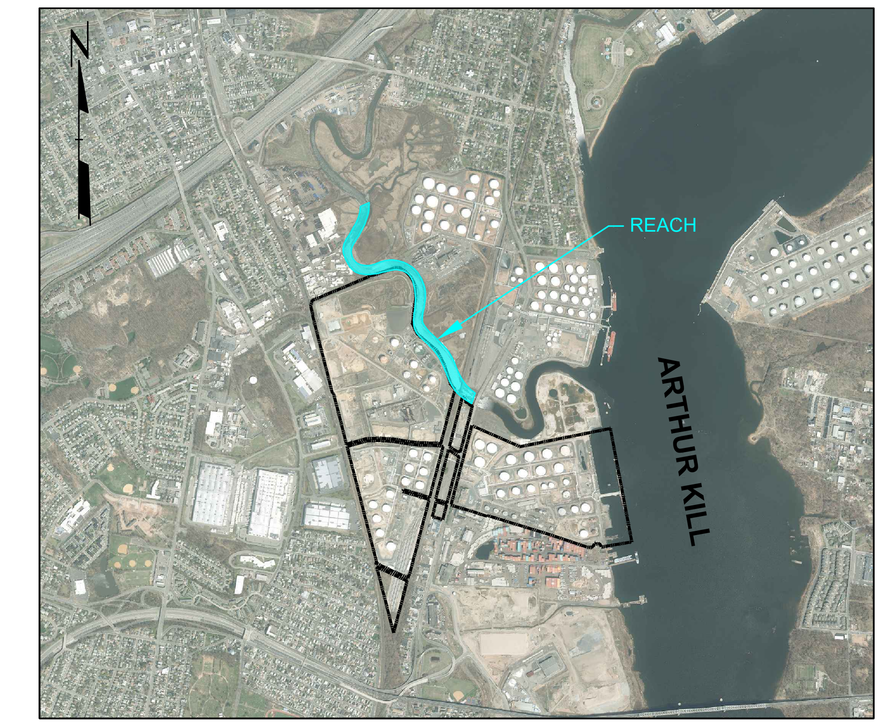
LEGEND

FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY

WATER FEATURE BOUNDARY (APPROXIMATE)

△ SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])

▲ PREVIOULSY SAMPLED LOCATION REVISITED IN 2019



KEYMAP

SCALE: 1"=2500'

NOTES:

1. TOP OF BANK ELEVATIONS ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).
3. SEDIMENT STRATA INCLUDE MINOR COMPONENTS (E.G. SHELLS; TRACES OF OTHER MATERIAL [SAND, GRAVEL..]) NOT DETAILED HERE.

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-03-A	SED-03-A/6.0-6.5	6-6.5	9/30/2019	Xylenes (total)	**3.9**
SED-03-B(R)	SED-03-B(R)/4.5-5.0	4.5-5	9/30/2019	Xylenes (total)	**0.465**
SED-03-C	SED-03-C/12-18	1-1.5	12/19/2002	Benzene	**20**
				Ethylbenzene	**5.5**
				Xylenes (total)	**26**
	SED-03-C/30-36	2.5-3	12/19/2002	Benzene	**15**
				Ethylbenzene	**3.9**
				Toluene	**2.9**
				Xylenes (total)	**27**
	SED-03-C/6-12	0.5-1	12/19/2002	Benzene	**3.4**
				Xylenes (total)	**3.6**
SED-03-C(R)	SED-03-C(R)/1.5-2.0	1.5-2	9/30/2019	Benzene	**0.9**
				1,2-Dichlorobenzene	0.11 J
				1,4-Dichlorobenzene	0.13 J
				Ethylbenzene	**7.2**
				Xylenes (total)	**28.1**
	SED-03-C(R)/6.0-6.5	6-6.5	9/30/2019	Benzene	**8.8**
				Ethylbenzene	**1.5**
				Xylenes (total)	**9.2**
SED-04-A	SED-04-A/39-45	3.25-3.75	12/19/2002	Xylenes (total)	**3**
SED-04-C(R)	SED-04-C(R)/1.5-2.0	1.5-2	10/1/2019	Xylenes (total)	**1.2**
				Xylenes (total)	**1.5**
	SED-04-C(R)/2.0-2.5	2-2.5	10/1/2019	Xylenes (total)	**0.94**
SED-05-C	SED-05-C/6.0-6.5	6-6.5	10/1/2019	Xylenes (total)	**5.5**
SED-06-A	SED-06-A/2.0-2.5	2-2.5	10/2/2019	Xylenes (total)	**0.195**
SED-06-C	SED-06-C/4.0-4.5(A)	4-4.5	10/2/2019	Benzene	**0.4** J
				1,2-Dichlorobenzene	0.083 J
				1,4-Dichlorobenzene	0.26 J
				Xylenes (total)	**1.23**
	SED-06-C/4.0-4.5(B)	4-4.5	10/2/2019	1,2-Dichlorobenzene	0.14 J
				1,4-Dichlorobenzene	0.36 J
				Xylenes (total)	**0.81**

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-09-A(R)	SED-09-A(R)/3.0-3.5	3-3.5	10/7/2019	Xylenes (total)	**0.22**
SED-09-B	SED-09-B/5.0-5.5	5-5.5	10/7/2019	Xylenes (total)	**0.32**
SED-09-C	SED-09-C/33-39	2.75-3.25	12/19/2002	Benzene	**3**
				Ethylbenzene	**6.6**
				Xylenes (total)	**29**
SED-09-C(R)	SED-09-C(R)/4.5-5.0	4.5-5	10/16/2019	Benzene	**0.54** J
				1,2-Dichlorobenzene	0.29 J
				Ethylbenzene	**5.9**
				Toluene	**4.4**
				Xylenes (total)	**29**
SED-23-A	SED-23-A/0.5-1.0	0.5-1	10/2/2019	Xylenes (total)	**0.17**
	SED-23-A/2.0-2.5	2-2.5	10/2/2019	Xylenes (total)	**0.19**
SED-23-B	SED-23-B/6.5-7.0	6.5-7	10/2/2019	Xylenes (total)	**0.45**
SED-23-C	SED-23-C/5.5-6.0	5.5-6	10/2/2019	Xylenes (total)	**0.67**
SED-24-A	SED-24-A/5.5-6.0(A)	5.5-6	10/4/2019	Benzene	**1.5**
				1,2-Dichlorobenzene	0.1 J
				Ethylbenzene	**8.9**
				Toluene	**5.8**
				Xylenes (total)	**53**
	SED-24-A/5.5-6.0(B)	5.5-6	10/4/2019	Benzene	**2.1**
				1,2-Dichlorobenzene	0.14 J
				Ethylbenzene	**10**
				Toluene	**12**
				Xylenes (total)	**56**
SED-24-C	SED-24-C/0.5-1.0	0.5-1	10/4/2019	Xylenes (total)	**0.76**
	SED-24-C/2.0-2.5	2-2.5	10/4/2019	Xylenes (total)	**1.32**

Parameter	ESC ER-L	ESC ER-M
Benzene	0.34	--
1,2-Dichlorobenzene	--	0.013
1,4-Dichlorobenzene	--	0.11
Ethylbenzene	1.4	--
Toluene	2.5	--
Xylenes (total)	0.12	--

Note:
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ESC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)
ESC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
Bold indicates concentrations above the ESC ER-L
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J = Estimated value below sample reporting limit
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U = Compound not detected above MDL
Values in italics indicate MDL above applicable criterion.
All concentrations are in milligrams per kilogram (mg/kg).
Only constituents with concentrations above the referenced standard or criteria are presented.

PROJECT:	**SEDIMENT INVESTIGATION REPORT CHEVRON FACILITY PERTH AMBOY, NEW JERSEY**
TITLE:	**SEDIMENT ANALYTICAL RESULTS - VOCs UPPER WOODBRIDGE CREEK**
DRAWN BY:	M. GIAMBATTISTA
CHECKED BY:	W. CORDASCO
APPROVED BY:	R. LIPPENCOTT
DATE:	FEBRUARY 2020
PROJ NO.:	326731.2020.0000
	FIGURE 6
FILE NO.:	BathymetricTransect figures_DATA.dwg

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41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

24x36 --- USER: LBochkis --- ATTACHED XREF'S: --- ATTACHED IMAGES: J8A14; J8A13; J8A14; J8A15; J8C1; J8C2; J8C3; J8C5; J8C6; J8C7;
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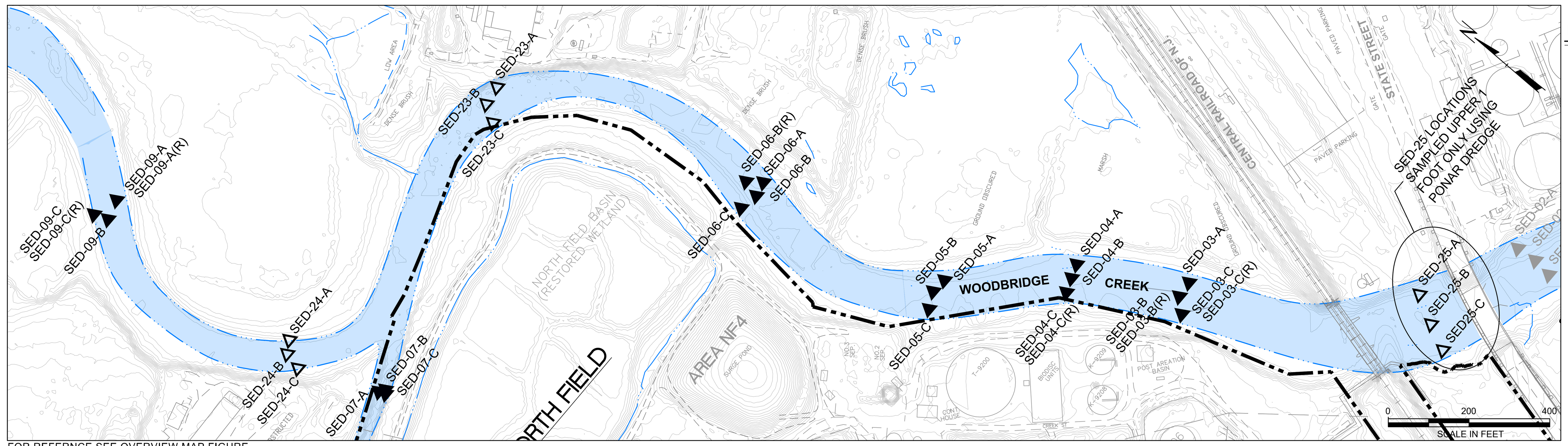
Version: 2017-10-21



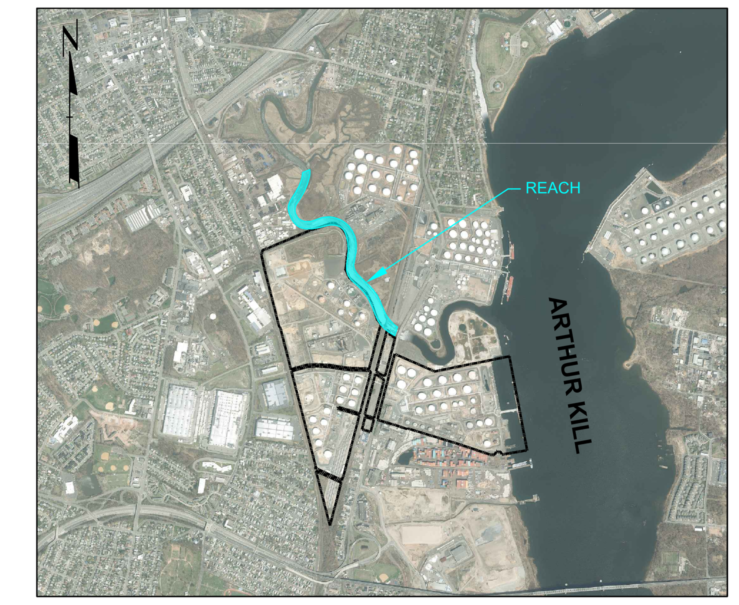
FOR REFERNCE SEE OVERVIEW MAP FIGURE ....

LEGEND

- FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY
- WATER FEATURE BOUNDARY (APPROXIMATE)
- SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])
- PREVIOULSY SAMPLED LOCATION REVISITED IN 2019

NOTES:

1. TOP OF BANK ELEVATIONS ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACCESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).
3. SEDIMENT STRATA INCLUDE MINOR COMPONENTS (E.G. SHELLS; TRACES OF OTHER MATERIAL [SAND, GRAVEL..]) NOT DETAILED HERE.



KEYMAP

SCALE: 1"=2500'

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-03-A	SED-03-A/0-6	0-0.5	12/19/2002	Acenaphthene	*0.086* J
				Acenaphthylene	**0.15**
				Anthracene	**0.36**
				Benzo(a)pyrene	**1.1**
				Benzo(a)anthracene	**1.3**
				Benzo(ghi)perylene	**1.6**
				Benzo(k)fluoranthene	**0.44**
				bis(2-Ethylhexyl)phthalate	**50**
				Chrysene	**2.3**
				Dibenz(a,h)anthracene	**0.35**
				Fluoranthene	**2**
				Indeno(1,2,3-cd)pyrene	**0.72**
				Phenanthrene	**0.25**
				Pyrene	**5.2**
				Total PAHs	**17.563**
	SED-03-A/6.0-6.5	6-6.5	9/30/2019	Anthracene	**0.98**
				Benzo(a)anthracene	**0.65**
				Benzo(ghi)perylene	**0.26**
				Chrysene	**1.2**
				Fluoranthene	**1.1**
				Fluorene	**1.2**
				Indeno(1,2,3-cd)pyrene	**0.23**
				2-Methylnaphthalene	**3.3**
				Naphthalene	**1.1**
				Phenanthrene	**5.3**
				Pyrene	**2**
				Total PAHs	**17.98**

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-03-A	SED-03-A/0.0-0.5	0-0.5	9/30/2019	EPH, TOTAL FRACTIONATED	2200
	SED-03-A/0.5-1.0	0.5-1	9/30/2019	EPH, TOTAL FRACTIONATED	12000
	SED-03-A/6.0-6.5	6-6.5	9/30/2019	EPH, TOTAL FRACTIONATED	11000
SED-03-B(R)	SED-03-B(R)	1.5-2	3/20/2014	EPH, TOTAL FRACTIONATED	7390
		4.5-5	3/20/2014	EPH, TOTAL FRACTIONATED	2430
	SED-03-B(R)/0.0-0.5	0-0.5	9/30/2019	EPH, TOTAL FRACTIONATED	620
	SED-03-B(R)/0.5-1.0	0.5-1	9/30/2019	EPH, TOTAL FRACTIONATED	700
SED-03-C(R)	SED-03-C(R)	1.5-2	3/20/2014	EPH, TOTAL FRACTIONATED	40200
		6-6.5	3/20/2014	EPH, TOTAL FRACTIONATED	12000
	SED-03-C(R)/0.0-0.5	0-0.5	9/30/2019	EPH, TOTAL FRACTIONATED	490
	SED-03-C(R)/0.5-1.0	0.5-1	9/30/2019	EPH, TOTAL FRACTIONATED	5400
	SED-03-C(R)/1.0-1.5	1-1.5	9/30/2019	EPH, TOTAL FRACTIONATED	16000
	SED-03-C(R)/2.5-3.0	2.5-3	9/30/2019	EPH, TOTAL FRACTIONATED	4300
SED-04-A	SED-04-A/0.0-0.5	0-0.5	10/1/2019	EPH, TOTAL FRACTIONATED	900
	SED-04-A/0.5-1.0	0.5-1	10/1/2019	EPH, TOTAL FRACTIONATED	2400
	SED-04-A/3.25-3.75	3.25-3.75	10/1/2019	EPH, TOTAL FRACTIONATED	14000
SED-04-B	SED-04-B/0.0-0.5	0-0.5	10/1/2019	EPH, TOTAL FRACTIONATED	480
	SED-04-B/0.5-1.0	0.5-1	10/1/2019	EPH, TOTAL FRACTIONATED	1400
	SED-04-B/2.0-2.5(A)	2-2.5	10/1/2019	EPH, TOTAL FRACTIONATED	1500
	SED-04-B/2.0-2.5(B)	2-2.5	10/1/2019	EPH, TOTAL FRACTIONATED	720
SED-04-C(R)	SED-04-C(R)	1.5-2	3/20/2014	EPH, TOTAL FRACTIONATED	1640
	SED-04-C(R)/0.0-0.5	0-0.5	10/1/2019	EPH, TOTAL FRACTIONATED	33000
	SED-04-C(R)/0.5-1.0	0.5-1	10/1/2019	EPH, TOTAL FRACTIONATED	24000
	SED-04-C(R)/2.0-2.5	2-2.5	10/1/2019	EPH, TOTAL FRACTIONATED	4900
SED-05-A	SED-05-A/0.0-0.5	0-0.5	10/1/2019	EPH, TOTAL FRACTIONATED	1400
	SED-05-A/0.5-1.0	0.5-1	10/1/2019	EPH, TOTAL FRACTIONATED	1900
	SED-05-A/2.0-2.5	2-2.5	10/1/2019	EPH, TOTAL FRACTIONATED	2500
SED-05-B	SED-05-B/0.0-0.5	0-0.5	10/1/2019	EPH, TOTAL FRACTIONATED	32
	SED-05-B/0.5-1.0	0.5-1	10/1/2019	EPH, TOTAL FRACTIONATED	98
	SED-05-B/2.0-2.5	2-2.5	10/1/2019	EPH, TOTAL FRACTIONATED	3500
SED-05-C	SED-05-C/0.0-0.5	0-0.5	10/1/2019	EPH, TOTAL FRACTIONATED	170
	SED-05-C/0.5-1.0	0.5-1	10/1/2019	EPH, TOTAL FRACTIONATED	5000
	SED-05-C/6.0-6.5	6-6.5	10/1/2019	EPH, TOTAL FRACTIONATED	4900
SED-06-A	SED-06-A/0.0-0.5	0-0.5	10/2/2019	EPH, TOTAL FRACTIONATED	2800
	SED-06-A/0.5-1.0	0.5-1	10/2/2019	EPH, TOTAL FRACTIONATED	3600
	SED-06-A/2.0-2.5	2-2.5	10/2/2019	EPH, TOTAL FRACTIONATED	4600
SED-06-B(R)	SED-06-B(R)	4-4.5	3/20/2014	EPH, TOTAL FRACTIONATED	3200
	SED-06-B(R)/0.0-0.5	0-0.5	10/2/2019	EPH, TOTAL FRACTIONATED	10 J
	SED-06-B(R)/0.5-1.0	0.5-1	10/2/2019	EPH, TOTAL FRACTIONATED	13
SED-06-C	SED-06-C/0.0-0.5	0-0.5	10/2/2019	EPH, TOTAL FRACTIONATED	1200
	SED-06-C/0.5-1.0	0.5-1	10/2/2019	EPH, TOTAL FRACTIONATED	1800
	SED-06-C/4.0-4.5(A)	4-4.5	10/2/2019	EPH, TOTAL FRACTIONATED	2500
	SED-06-C/4.0-4.5(B)	4-4.5	10/2/2019	EPH, TOTAL FRACTIONATED	14000
SED-09-A(R)	SED-09-A(R)	3-3.5	3/20/2014	EPH, TOTAL FRACTIONATED	5110
	SED-09-A(R)/0.0-0.5	0-0.5	10/7/2019	EPH, TOTAL FRACTIONATED	960
	SED-09-A(R)/0.5-1.0	0.5-1	10/7/2019	EPH, TOTAL FRACTIONATED	2600
SED-09-B	SED-09-B/0.0-0.5	0-0.5	10/7/2019	EPH, TOTAL FRACTIONATED	35
	SED-09-B/0.5-1.0	0.5-1	10/7/2019	EPH, TOTAL FRACTIONATED	130
	SED-09-B/5.0-5.5	5-5.5	10/7/2019	EPH, TOTAL FRACTIONATED	4600
SED-09-C(R)	SED-09-C(R)	4.5-5	3/20/2014	EPH, TOTAL FRACTIONATED	27700
	SED-09-C(R)/0.0-0.5	0-0.5	10/16/2019	EPH, TOTAL FRACTIONATED	1300
	SED-09-C(R)/0.5-1.0	0.5-1	10/16/2019	EPH, TOTAL FRACTIONATED	4200
	SED-09-C(R)/2.75-3.25	2.75-3.25	10/16/2019	EPH, TOTAL FRACTIONATED	6900
SED-23-A	SED-23-A/0.0-0.5	0-0.5	10/2/2019	EPH, TOTAL FRACTIONATED	18000
	SED-23-A/2.0-2.5	2-2.5	10/2/2019	EPH, TOTAL FRACTIONATED	23000
SED-23-B	SED-23-B/0.0-0.5	0-0.5	10/2/2019	EPH, TOTAL FRACTIONATED	220
	SED-23-B/6.5-7.0	6.5-7	10/2/2019	EPH, TOTAL FRACTIONATED	6900
SED-23-C	SED-23-C/0.0-0.5	0-0.5	10/2/2019	EPH, TOTAL FRACTIONATED	200
	SED-23-C/5.5-6.0	5.5-6	10/2/2019	EPH, TOTAL FRACTIONATED	10000
SED-24-A	SED-24-A/0.0-0.5	0-0.5	10/4/2019	EPH, TOTAL FRACTIONATED	1200
	SED-24-A/5.5-6.0(A)	5.5-6	10/4/2019	EPH, TOTAL FRACTIONATED	26000
	SED-24-A/5.5-6.0(B)	5.5-6	10/4/2019	EPH, TOTAL FRACTIONATED	18000
SED-24-B	SED-24-B/0.0-0.5	0-0.5	10/4/2019	EPH, TOTAL FRACTIONATED	15
	SED-24-B/2.0-2.5	2-2.5	10/4/2019	EPH, TOTAL FRACTIONATED	52
SED-24-C	SED-24-C/0.0-0.5	0-0.5	10/4/2019	EPH, TOTAL FRACTIONATED	10000
	SED-24-C/2.0-2.5	2-2.5	10/4/2019	EPH, TOTAL FRACTIONATED	12000
SED-25-A	SED-25-A/0.0-0.5	0-0.5	10/25/2019	EPH, TOTAL FRACTIONATED	1000
SED-25-B	SED-25-B/0.0-0.5	0-0.5	10/24/2019	EPH, TOTAL FRACTIONATED	1700
SED-25-C	SED-25-C/0.0-0.5	0-0.5	10/24/2019	EPH, TOTAL FRACTIONATED	910

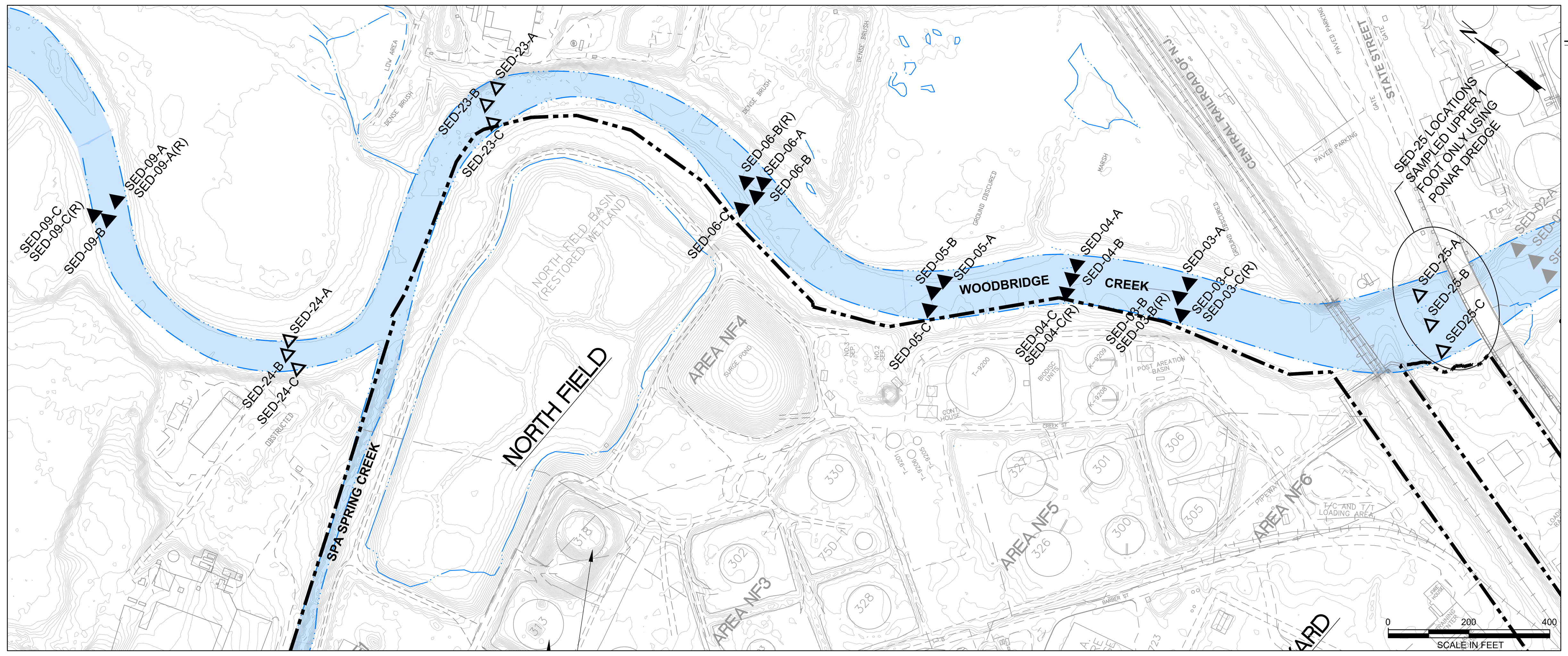
Parameter	ESC ER-L	ESC ER-M
Acenaphthene	0.016	0.5
Acenaphthylene	0.044	0.64
Anthracene	0.085	1.1
Benzo(a)pyrene	0.43	1.6
Benzo(a)anthracene	0.261	1.6
Benzo(b)fluoranthene	--	1.8
Benzo(ghi)perylene	0.17	--
Benzo(k)fluoranthene	0.24	--
bis(2-Ethylhexyl)phthalate	0.18216	2.64651
Chrysene	0.384	2.8
Dibenz(a,h)anthracene	0.063	0.26
EPH, TOTAL FRACTIONATED	--	--
Fluoranthene	0.6	5.1
Fluorene	0.019	0.54
Indeno(1,2,3-cd)pyrene	0.2	--
2-Methylnaphthalene	0.07	0.67
Naphthalene	0.16	2.1
Phenanthrene	0.24	1.5
Phenol	--	0.13
Pyrene	0.665	2.6
Total PAHs	4	45

Note:
ESC = NJDEP Ecological Screening Criteria, March 2009
ESC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)
ESC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
Bold indicates concentrations above the ESC ER-L
Underline indicates concentrations above the ESC ER-M
ND = Not Detected
NA = Not Analyzed
J = Estimated value below sample reporting limit
MDL = Method Detection Limit
U = Compound not detected above MDL
Values in italics indicate MDL above applicable criterion.
All concentrations are in milligrams per kilogram (mg/kg).
Only constituents with concentrations above the referenced standard or criteria are presented.

PROJECT:	SEDIMENT INVESTIGATION REPORT CHEVRON FACILITY PERTH AMBOY, NEW JERSEY
TITLE:	SEDIMENT ANALYTICAL RESULTS - SVOC/EPH WOODBRIDGE CREEK - UPPER REACH
DRAWN BY: M. GIAMBATTISTA	PROJ. NO.: 326731.2020.0000
CHECKED BY: W. CORDASCO	FIGURE 7
APPROVED BY: R. LIPPENCOTT	
DATE: FEBRUARY 2020	

TRC
41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: BathymetricTransect figures_DATA.dwg



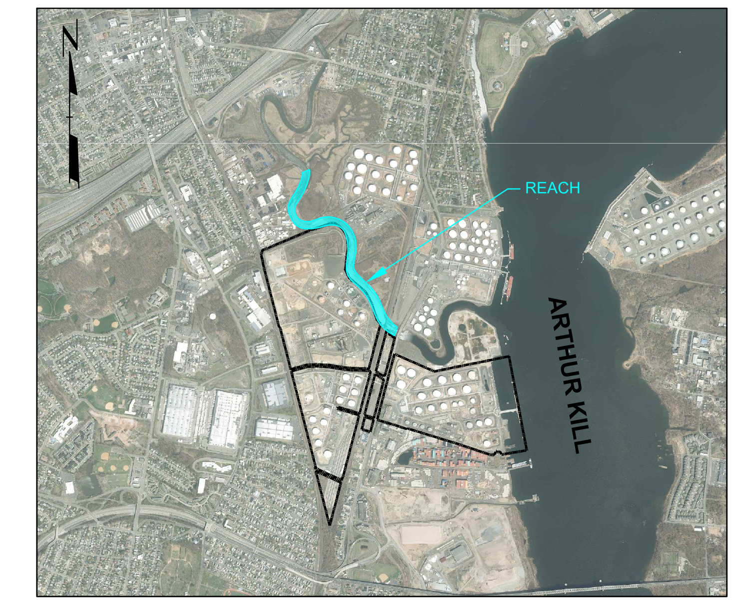
LEGEND

FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY

WATER FEATURE BOUNDARY (APPROXIMATE)

△ SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])

▲ PREVIOUSLY SAMPLED LOCATION REVISITED IN 2019



KEYMAP

SCALE: 1"=2500'

NOTES:

1. TOP OF BANK ELEVATIONS ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACCESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).
3. SEDIMENT STRATA INCLUDE MINOR COMPONENTS (E.G. SHELLS; TRACES OF OTHER MATERIAL [SAND, GRAVEL..]) NOT DETAILED HERE.

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-03-A	SED-03-A/0-6	0-0.5	12/19/2002	Aluminum	21200
				Arsenic	52.4
				Barium	181
				Cadmium	13
				Chromium	128
				Cobalt	51
				Copper	2210
				Lead	244
				Mercury	3.2
				Nickel	627
				Selenium	88.1
				Silver	4.2 J
				Vanadium	73.2
				Zinc	743
	SED-03-A/6.0-6.5	6-6.5	9/30/2019	Aluminum	26100
				Antimony	10.4
				Arsenic	117
				Barium	438
				Cadmium	7.38
				Chromium	119
				Cobalt	12.5
				Copper	765
				Lead	429
				Manganese	342
				Mercury	2.91
				Nickel	53.7
				Selenium	7.92
				Silver	5
				Vanadium	61.5
				Zinc	749
SED-03-B	SED-03-B/0-6	0-0.5	12/19/2002	Arsenic	16.8
				Cobalt	16
				Copper	629
				Lead	166
				Mercury	0.42
				Nickel	125
				Selenium	43.1
				Silver	1.1 J
				Zinc	441
SED-03-B(R)	SED-03-B(R)/1.5-2.0	1.5-2	9/30/2019	Aluminum	18500
				Arsenic	17.8
				Barium	65.4
				Cadmium	2.16
				Cobalt	20.9
				Copper	905
				Lead	167
				Mercury	0.485
				Nickel	163
				Selenium	57
				Silver	1.89
				Vanadium	60.1
				Zinc	313
	SED-03-B(R)/4.5-5.0	4.5-5	9/30/2019	Arsenic	17.8
				Barium	74.4
				Cobalt	11.6
				Copper	100
				Lead	58.1
				Manganese	496
				Mercury	0.498
				Nickel	35.1
SED-03-C	SED-03-C/0-6	0-0.5	12/19/2002	Aluminum	19000
				Arsenic	65.7
				Barium	128
				Cadmium	11.1
				Chromium	142
				Cobalt	13.2
				Copper	664
				Lead	381
				Mercury	4.1
				Nickel	96.2
				Selenium	38
				Silver	4.1 J
				Vanadium	95.5
				Zinc	690
	SED-03-C/12-18	1-1.5	12/19/2002	Aluminum	21600
				Arsenic	91.7
				Barium	272
				Cadmium	8.2
				Chromium	166
				Cobalt	13.2
				Copper	601
				Lead	399
				Manganese	277
				Mercury	5.8
				Nickel	53
				Selenium	7.1
				Silver	3.9 J
				Vanadium	62.5
				Zinc	676
	SED-03-C/30-36	2.5-3	12/19/2002	Aluminum	25200
				Arsenic	39.2
				Barium	121
				Cadmium	2.6 J
				Cobalt	13.6
				Copper	121
				Lead	82.6
				Manganese	363
				Mercury	1.3
				Nickel	36.1
				Selenium	3.3
				Silver	1.3 J
				Zinc	210
SED-03-C(R)	SED-03-C(R)/1.5-2.0	1.5-2	9/30/2019	Aluminum	18700
				Arsenic	82
				Barium	216
				Cadmium	11.9
				Chromium	114
				Cobalt	11.3
				Copper	1000
				Lead	318
				Mercury	8.54
				Nickel	92.2
				Selenium	14.1
				Silver	4.92
				Vanadium	70.5
				Zinc	753
	SED-03-C(R)/6.0-6.5	6-6.5	9/30/2019	Aluminum	24100
				Arsenic	36.5
				Barium	96.7
				Cobalt	12.3
				Copper	106
				Lead	57.2
				Manganese	319
				Mercury	0.762
				Nickel	31.4
				Silver	1.7 J
				Zinc	170

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-04-A	SED-04-A/0-6	0-0.5	12/19/2002	Arsenic	9.4
				Cadmium	2 J
				Copper	313
				Lead	113
				Mercury	0.49
				Nickel	64.2
				Selenium	15.5
				Zinc	283
	SED-04-A/3.25-3.75	3.25-3.75	10/1/2019	Arsenic	70
				Barium	208
				Cadmium	5.77
				Chromium	127
				Cobalt	11.4
				Copper	638
				Lead	399
				Manganese	284
				Mercury	4.76
				Nickel	65.2
				Selenium	2.7 J
				Silver	3.3
				Zinc	616
	SED-04-A/39-45	3.25-3.75	12/19/2002	Arsenic	43.6
				Barium	96.4
				Cadmium	3 J
				Cobalt	23.5
				Copper	322
				Lead	393
				Mercury	1.7
				Nickel	63.4
				Selenium	6.5
				Silver	1.5 J
				Zinc	550
SED-04-B	SED-04-B/0-6	0-0.5	12/19/2002	Copper	313
				Lead	68.1
				Mercury	0.18
				Nickel	55.4
				Selenium	12.7
				Zinc	228
	SED-04-B/2.0-2.5(A)	2-2.5	10/1/2019	Arsenic	34.4
				Barium	104
				Cadmium	1.32
				Copper	157
				Lead	115
				Mercury	1.28
				Nickel	28.3
				Zinc	222
	SED-04-B/2.0-2.5(B)	2-2.5	10/1/2019	Arsenic	28.5
				Barium	68.5
				Cobalt	12.6
				Copper	131
				Lead	61.6
				Manganese	338
				Mercury	0.641
				Nickel	41.1
				Zinc	232
SED-04-C	SED-04-C/0-6	0-0.5	12/19/2002	Aluminum	23400
				Arsenic	8.6
				Barium	51.9
				Cadmium	1.4 J
				Cobalt	10.4 J
				Manganese	281
				Nickel	28.6
				Selenium	1.7 J
SED-04-C(R)	SED-04-C(R)/1.5-2.0	1.5-2	10/1/2019	Aluminum	22300
				Arsenic	39.4
				Barium	300
				Chromium	82.9
				Cobalt	10.7
				Copper	260
				Lead	212
				Mercury	1.18
				Nickel	37.1
				Zinc	269
	SED-04-C(R)/2.0-2.5	2-2.5	10/1/2019	Aluminum	19900
				Arsenic	68.2
				Barium	173
				Cadmium	1.26
				Cobalt	10.6
				Copper	403
				Lead	218
				Manganese	280
				Mercury	2.18
				Nickel	54.9
				Selenium	7 J
				Zinc	335
SED-05-A	SED-05-A/0-6	0-0.5	12/19/2002	Arsenic	11.7
				Cadmium	1.6 J
				Copper	595
				Lead	107
				Mercury	0.19
				Nickel	86.9
				Selenium	3.9
				Zinc	359
	SED-05-A/2.0-2.5	2-2.5	10/1/2019	Arsenic	27.1
				Barium	78.4
				Cadmium	5.53
				Cobalt	59.6
				Copper	2400
				Lead	411
				Mercury	0.956
				Nickel	272
				Selenium	3.71 J
				Silver	1.54 J
				Zinc	1550
SED-05-B	SED-05-B/0-6	0-0.5	12/19/2002	Copper	355
				Lead	47.1
				Nickel	38.7
				Selenium	4.4
				Zinc	174
	SED-05-B/2.0-2.5	2-2.5	10/1/2019	Arsenic	18.6
				Cadmium	4.49
				Cobalt	13.6
				Copper	1090
				Lead	149
				Mercury	0.279
				Nickel	184
				Selenium	9.75
				Zinc	1060

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-05-C	SED-05-C/0-6	0-0.5	12/19/2002	Aluminum	21400
				Arsenic	34.4
				Barium	129
				Cadmium	2.8 J
				Chromium	97.5
				Cobalt	85.9
				Copper	8030
				Lead	378
				Manganese	322
				Mercury	2
				Nickel	2480
				Selenium	5.2
				Silver	5.4
				Vanadium	66
				Zinc	2970
	SED-05-C/6.0-6.5	6-6.5	10/1/2019	Arsenic	76.1
				Barium	257
				Cadmium	1.64
				Cobalt	10.6
				Copper	455
				Lead	238
				Manganese	309
				Mercury	1.65
				Nickel	60.5
				Selenium	4.52 J
				Silver	1.11 J
				Zinc	490
SED-06-A	SED-06-A/0-6	0-0.5	12/19/2002	Aluminum	20900
				Arsenic	14.6
				Barium	48.3
				Cobalt	12.5
				Copper	47.2
				Manganese	366
				Nickel	42
	SED-06-A/2.0-2.5	2-2.5	10/2/2019	Aluminum	19300
				Arsenic	48.2
				Barium	151
				Cadmium	1.36
				Cobalt	11.9
				Copper	369
				Lead	189
				Manganese	406
				Mercury	1.13
				Nickel	48.9
				Silver	1.9
				Zinc	344
SED-06-B	SED-06-B/0-6	0-0.5	12/19/2002	Arsenic	8.5
				Copper	206
				Lead	90.4
				Nickel	59.8
				Selenium	4.4
				Zinc	323
SED-06-B(R)	SED-06-B(R)/4.0-4.5	4-4.5	10/2/2019	Arsenic	93
				Barium	221
				Cadmium	5.1
				Chromium	105
				Copper	408
				Lead	273
				Mercury	3.85
				Nickel	39.5
				Silver	3.6
				Zinc	422
SED-06-C	SED-06-C/0-6	0-0.5	12/19/2002	Arsenic	8.5
				Barium	51.2
				Cadmium	1.5 J
				Copper	223
				Lead	113
				Mercury	0.47
				Nickel	38.4
				Selenium	9.8
				Zinc	258
	SED-06-C/4.0-4.5(A)	4-4.5	10/2/2019	Arsenic	44.2
				Barium	133
				Cadmium	2.38
				Cobalt	10.1
				Copper	775
				Lead	298
				Mercury	1.02
				Nickel	63.4
				Silver	2.14
				Vanadium	69.7
				Zinc	338
	SED-06-C/4.0-4.5(B)	4-4.5	10/2/2019	Arsenic	61.5
				Barium	124
				Cadmium	5.62
				Chromium	88.1
				Cobalt	10.6
				Copper	593
				Lead	380
				Mercury	1.79
				Nickel	74.6
				Selenium	3.16 J
				Silver	3.3
				Vanadium	68.5
				Zinc	443
SED-09-A	SED-09-A/0-6	0-0.5	12/19/2002	Aluminum	21000
				Arsenic	17.6
				Barium	76.1
				Cadmium	4.3
				Cobalt	17.6
				Copper	489
				Lead	86.3
				Manganese	302
				Mercury	0.45
				Nickel	290
				Selenium	9.9
				Zinc	251
SED-09-A(R)	SED-09-A(R)/3.0-3.5	3-3.5	10/7/2019	Aluminum	26600
				Arsenic	95.3
				Barium	162
				Cadmium	1.87
				Chromium	90.9
				Cobalt	15.9
				Copper	264
				Lead	191
				Manganese	535
				Mercury	2.12
				Nickel	46.2
				Silver	2.58
				Vanadium	73.7
				Zinc	283

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-09-B	SED-09-B/0-6	0-0.5	12/19/2002	Copper	271
				Lead	65.3
				Mercury	0.19
				Nickel	43.9
				Selenium	1.4
				Zinc	218
	SED-09-B/5.0-5.5	5-5.5	10/7/2019	Arsenic	34.3
				Cadmium	7.44
				Copper	222
				Lead	113
				Mercury	0.268
				Nickel	84.5
				Selenium	11.8
				Zinc	313
SED-09-C	SED-09-C/0-6	0-0.5	12/19/2002	Arsenic	22
				Barium	95.2
				Cadmium	4.1 J
				Cobalt	18.9
				Copper	545
				Lead	196
				Mercury	1.4
				Nickel	94.5
				Selenium	17.8
				Silver	1.8 J
				Vanadium	61.1
				Zinc	542
	SED-09-C/33-39	2.75-3.25	12/19/2002	Aluminum	19100
				Arsenic	64.5
				Barium	179
				Cadmium	13
				Chromium	126
				Cobalt	15.3
				Copper	572
				Lead	399
				Mercury	4
				Nickel	117
				Selenium	154
				Silver	3.6 J
				Vanadium	100
				Zinc	775
SED-09-C(R)	SED-09-C(R)/4.5-5.0	4.5-5	10/16/2019	Arsenic	105
				Barium	357
				Cadmium	15.2
				Chromium	156
				Cobalt	29.2
				Copper	921
				Lead	1160
				Mercury	8.39
				Nickel	226
				Silver	15.9
				Vanadium	62.3
				Zinc	1240
SED-23-A	SED-23-A/0.0-0.5	0-0.5	10/2/2019	Arsenic	330
				Barium	275
				Cadmium	5.92
				Chromium	130
				Cobalt	12.3
				Copper	624
				Lead	522
				Manganese	287
				Mercury	6.13
				Nickel	72.2
				Silver	4.48
				Vanadium	58.4
				Zinc	683
	SED-23-A/2.0-2.5	2-2.5	10/2/2019	Aluminum	19800
				Antimony	26.6
				Arsenic	1100
				Barium	361
				Cadmium	6.49
				Chromium	147
				Cobalt	12.1
				Copper	844
				Lead	539
				Manganese	360
				Mercury	6.33
				Nickel	55
				Silver	5.93
				Vanadium	61.9
				Zinc	771
SED-23-B	SED-23-B/0.0-0.5	0-0.5	10/2/2019	Copper	183
				Lead	124
				Nickel	58.7
				Selenium	5.37
				Zinc	329
	SED-23-B/6.5-7.0	6.5-7	10/2/2019	Aluminum	19400
				Arsenic	228
				Barium	502
				Cadmium	7.56
				Chromium	161
				Cobalt	11.7
				Copper	699
				Lead	443
				Manganese	382
				Mercury	7.06
				Nickel	45.9
				Silver	5.29
				Vanadium	61.5
				Zinc	950

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-23-C	SED-23-C/0.0-0.5	0-0.5	10/2/2019	Cobalt	10.7
				Copper	97.2
				Lead	68.4
				Nickel	27.1
				Selenium	45
				Zinc	229
	SED-23-C/5.5-6.0	5.5-6	10/2/2019	Arsenic	88.7
				Barium	217
				Cadmium	5.16
				Chromium	95.7
				Cobalt	10.3
				Copper	373
				Lead	312
				Mercury	3.24
				Nickel	37.8
				Silver	3.25
				Zinc	488
SED-24-A	SED-24-A/0.0-0.5	0-0.5	10/4/2019	Arsenic	18.2
				Barium	61.8
				Cadmium	2.36
				Cobalt	14.1
				Copper	548
				Lead	209
				Mercury	0.847
				Nickel	93.4
				Silver	3
				Zinc	509
	SED-24-A/5.5-6.0(A)	5.5-6	10/4/2019	Arsenic	101
				Barium	288
				Cadmium	9.32
				Chromium	121
				Cobalt	17.1
				Copper	851
				Lead	732
				Mercury	4.77
				Nickel	160
				Selenium	5.53 J
				Silver	7.62
				Vanadium	58.1
				Zinc	1820
	SED-24-A/5.5-6.0(B)	5.5-6	10/4/2019	Arsenic	66.8
				Barium	173
				Cadmium	8.43
				Chromium	81.6
				Cobalt	16
				Copper	539
				Lead	526
				Mercury	5.3
				Nickel	122
				Selenium	4.64 J
				Silver	5.8
				Zinc	1010
SED-24-B	SED-24-B/0.0-0.5	0-0.5	10/4/2019	Copper	97
				Lead	49.3
				Nickel	27.4
				Zinc	321
	SED-24-B/2.0-2.5	2-2.5	10/4/2019	Copper	259
				Lead	54.7
				Nickel	41.1
				Selenium	111
				Silver	1.06
				Zinc	399
SED-24-C	SED-24-C/0.0-0.5	0-0.5	10/4/2019	Aluminum	18400
				Arsenic	61.8
				Barium	210
				Cadmium	6.77
				Chromium	103
				Cobalt	13
				Copper	562
				Lead	409
				Manganese	272
				Mercury	3.57
				Nickel	94
				Selenium	12.4
				Silver	4.97
				Vanadium	73.3
				Zinc	588
	SED-24-C/2.0-2.5	2-2.5	10/4/2019	Arsenic	33.6
				Barium	129
				Cadmium	2.22
				Cobalt	10.6
				Copper	218
				Lead	181
				Manganese	327
				Mercury	1.41
				Nickel	43
				Silver	3.07
				Zinc	260
SED-25-A	SED-25-A/0.0-0.5	0-0.5	10/25/2019	Arsenic	16.4
				Barium	56.1
				Copper	262
				Lead	114
				Mercury	1.25
				Nickel	38.6
				Selenium	3.52 J
				Silver	1.18 J
				Zinc	243
SED-25-B	SED-25-B/0.0-0.5	0-0.5	10/24/2019	Copper	160
				Lead	52.7
				Nickel	28.4
SED-25-C	SED-25-C/0.0-0.5	0-0.5	10/24/2019	Arsenic	18.1
				Barium	78.4
				Cadmium	2.31
				Cobalt	11.4
				Copper	364
				Lead	128
				Mercury	1.06
				Nickel	64.3
				Silver	2.62
				Zinc	315

Parameter	ESC ER-L	ESC ER-M
Aluminum	--	18000
Antimony	--	9.3
Arsenic	8.2	70
Barium	--	48
Cadmium	1.2	9.6
Chromium	81	370
Cobalt	--	10
Copper	34	270
Lead	47	218
Manganese	--	260
Mercury	0.15	0.71
Nickel	21	52
Selenium	--	1
Silver	1	3.7
Vanadium	--	57
Zinc	150	410

lote:
SC = NJDEP Ecological Screening Criteria, March 2009
SC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)
SC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
old indicates concentrations above the ESC ER-L
Inderline indicates concentrations above the ESC ER-M
ID = Not Detected
IA = Not Analyzed
= Estimated value below sample reporting limit
ADL = Method Detection Limit
I = Compound not detected above MDL
'alues in italics indicate MDL above applicable criterion.
JI concentrations are in milligrams per kilogram (mg/kg).
Inly constituents with concentrations above the referenced standard or criteria are presented.

PROJECT:
SEDIMENT INVESTIGATION REPORT
CHEVRON FACILITY
PERTH AMBOY, NEW JERSEY

TITLE:
SEDIMENT ANALYTICAL RESULTS - METALS
WOODBRIDGE CREEK - UPPER REACH

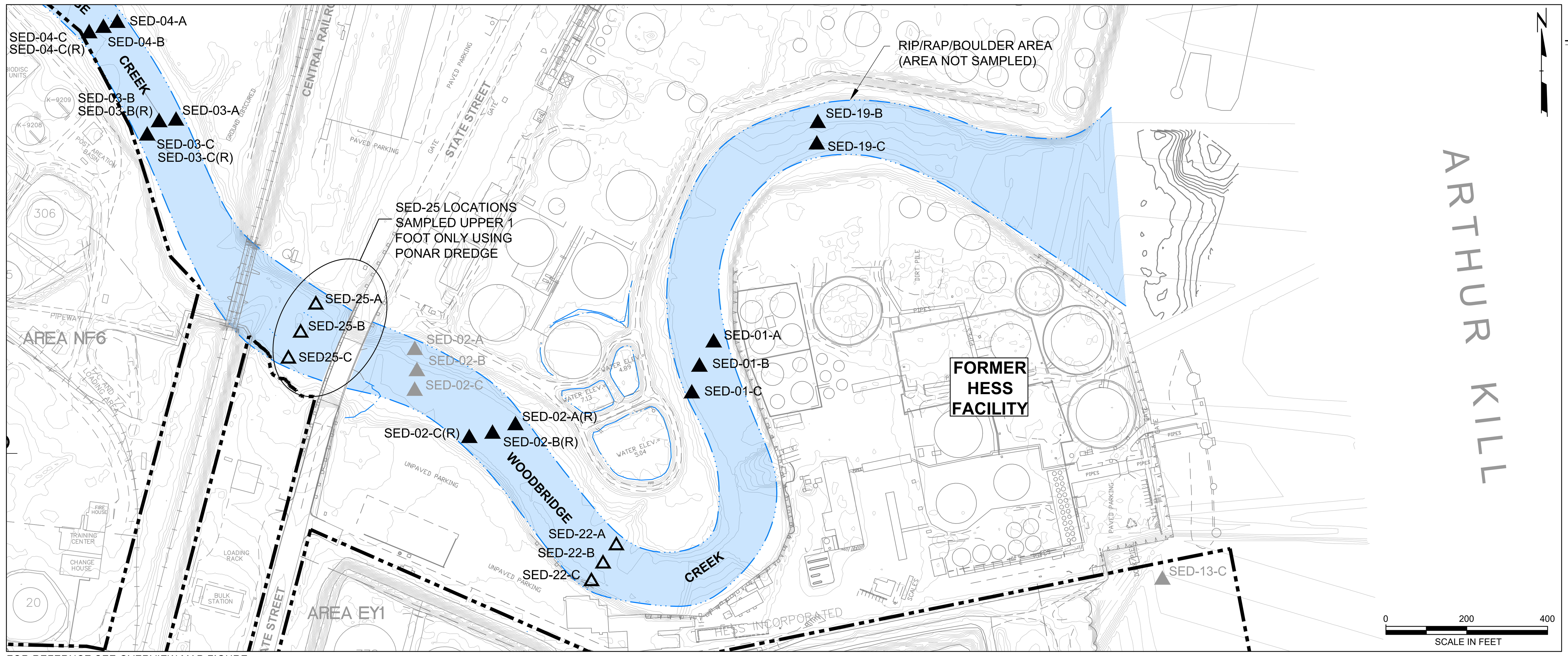
DRAWN BY:	M. GIAMBATTISTA	PROJ. NO.:	326731.2020.0000
CHECKED BY:	W. CORDASCO		
APPROVED BY:	R. LIPPENCOTT		**FIGURE 8**
DATE:	FEBRUARY 2020		

TRC
41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: BathymetricTransect figures_DATA.dwg

DRAWING NAME: M:\Cad Files\WORK\890\2019\Bathymetric\Final\ Bathymetric\Transect figures_DATA.dwg --- PLOT DATE: May 15, 2020 - 9:43AM --- LAYOUT: UPPER METALS

Version: 2017-10-21



FOR REFENCE SEE OVERVIEW MAP FIGURE ....

PLAN VIEW

LEGEND

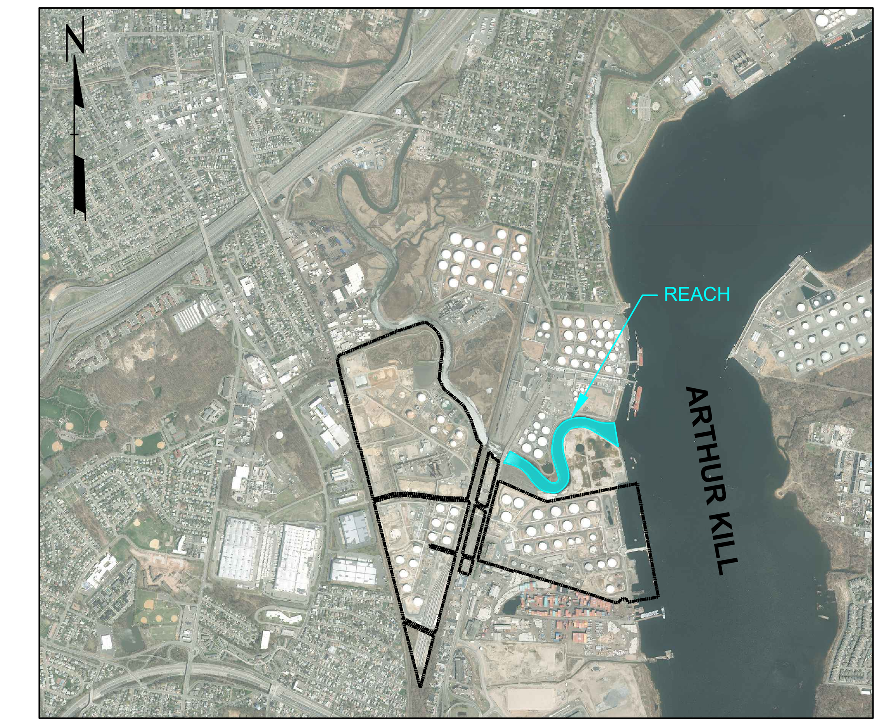
FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY

WATER FEATURE BOUNDARY (APPROXIMATE)

SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])

PREVIOULSY SAMPLED LOCATION REVISITED IN 2019

SEDIMENT SAMPLE LOCATIONS 2002 (NOT SUBSEQUENTLY SAMPLED)



KEYMAP

SCALE: 1"=2500'

NOTES:

1. TOP OF BANK ELEVATIONS ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACCESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).
3. SEDIMENT STRATA INCLUDE MINOR COMPONENTS (E.G. SHELLS; TRACES OF OTHER MATERIAL [SAND, GRAVEL..]) NOT DETAILED HERE.
4. SED-02-A,B,C NOT RE-SAMPLED DUE TO UTILITY PROXIMITY.

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)	
SED-01-A	SED-01-A/6-12	0.5-1	12/20/2002	1,2,4-Trichlorobenzene	0.21	J
SED-02-A(R)	SED-02-A(R)/6.0-6.5	6-6.5	9/27/2019	Xylenes (total)	**1.56**	
SED-02-C(R)	SED-02-C(R)/2.0-2.5	2-2.5	9/27/2019	Xylenes (total)	**5**	
SED-19-B	SED-19-B	6-6.5	3/21/2014	Benzene	**0.437**	
				1,2-Dichlorobenzene	0.0781	J
				1,4-Dichlorobenzene	0.391	J
				Xylenes (total)	**4.66**	
SED-19-C	SED-19-C	7.5-8	3/21/2014	1,4-Dichlorobenzene	0.971	J
				Ethylbenzene	**2.27**	
				Xylenes (total)	**9.67**	
SED-22-B	SED-22-B/0.5-1.0	0.5-1	9/25/2019	Xylenes (total)	**0.29**	
	SED-22-B/9.0-9.5	9-9.5	9/25/2019	Xylenes (total)	**1.48**	
SED-22-C	SED-22-C/0.5-1.0	0.5-1	9/26/2019	1,4-Dichlorobenzene	0.37	J
				Xylenes (total)	**0.71**	
	SED-22-C/4.5-5.0	4.5-5	9/26/2019	Xylenes (total)	**2.8**	

Parameter	ESC ER-L	ESC ER-M
Benzene	0.34	--
1,2-Dichlorobenzene	--	0.013
1,4-Dichlorobenzene	--	0.11
Ethylbenzene	1.4	--
1,2,4-Trichlorobenzene	--	0.0048
Xylenes (total)	0.12	--

Note:
ESC = NJDEP Ecological Screening Criteria, March 2009
ESC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)
ESC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
Bold indicates concentrations above the ESC ER-L
Underline indicates concentrations above the ESC ER-M
ND = Not Detected
NA = Not Analyzed
J = Estimated value below sample reporting limit
MDL = Method Detection Limit
U = Compound not detected above MDL
Values in italics indicate MDL above applicable criterion.
All concentrations are in milligrams per kilogram (mg/kg).
Only constituents with concentrations above the referenced standard or criteria are presented.

PROJECT: SEDIMENT INVESTIGATION REPORT
CHEVRON FACILITY
PERTH AMBOY, NEW JERSEY

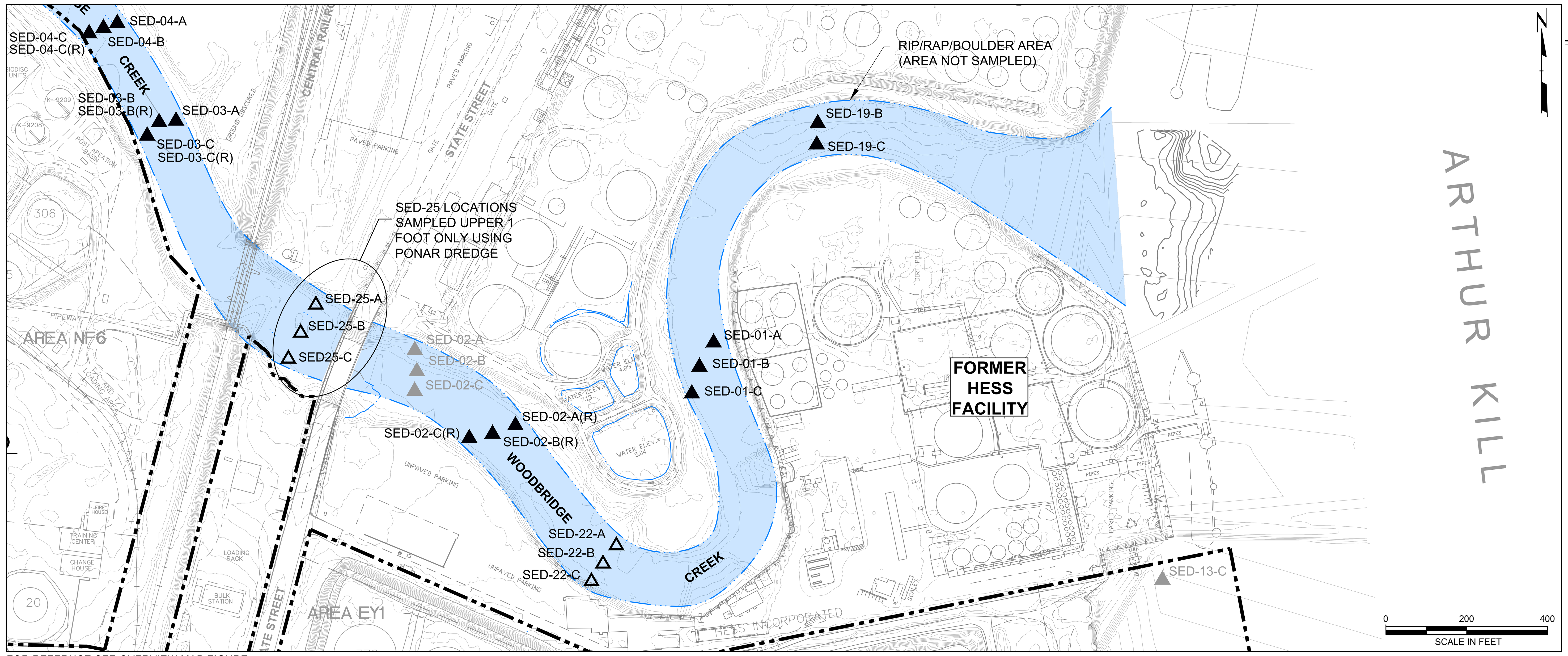
TITLE: SEDIMENT ANALYTICAL RESULTS - VOC
WOODBRIDGE CREEK - LOWER REACH

DRAWN BY:	M. GIAMBATTISTA	PROJ NO.:	326731.2020.0000
CHECKED BY:	W. CORDASCO	FIGURE 9	
APPROVED BY:	R. LIPPENCOTT		
DATE:	FEBRUARY 2020		

TRC
41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: BathymetricTransect figures_DATA.dwg

DRAWING NAME: M:\Cad Files\WORK\9902019\Bathymetric\Final\ Bathymetric Transect figures_DATA.dwg — PLOT DATE: May 15, 2020 - 9:44AM — LAYOUT: LOW VOC



FOR REFERNCE SEE OVERVIEW MAP FIGURE ....

PLAN VIEW

LEGEND

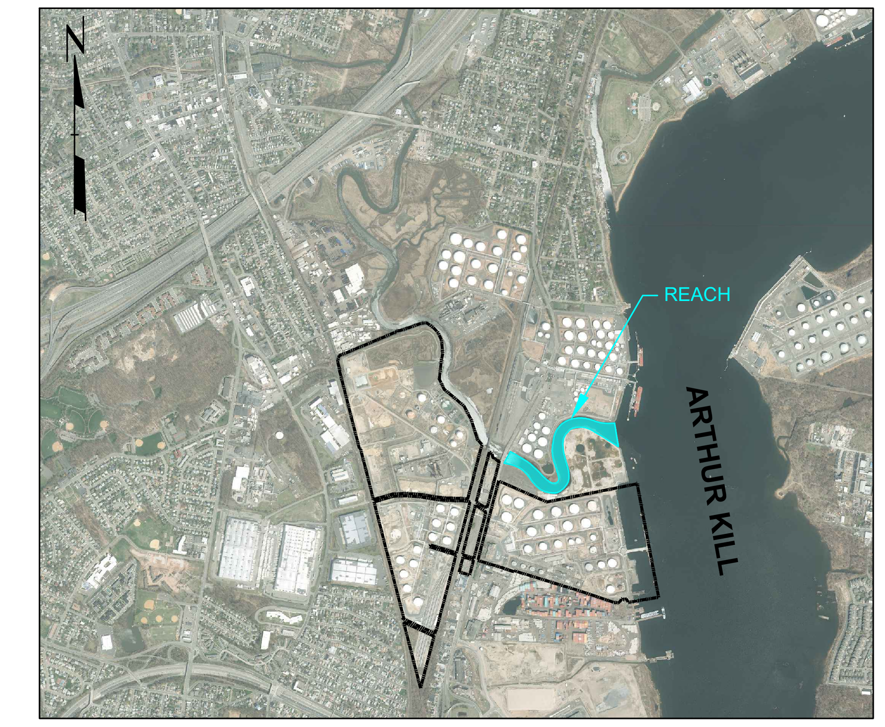
FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY

WATER FEATURE BOUNDARY (APPROXIMATE)

SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])

PREVIOULSY SAMPLED LOCATION REVISITED IN 2019

SEDIMENT SAMPLE LOCATIONS 2002 (NOT SUBSEQUENTLY SAMPLED)



KEYMAP

SCALE: 1"=2500'

NOTES:

1. TOP OF BANK ELEVATION ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).
3. SEDIMENT STRATA INCLUDE MINOR COMPONENTS (E.G. SHELLS; TRACES OF OTHER MATERIAL [SAND, GRAVEL..]) NOT DETAILED HERE.
4. SED-02-A,B,C NOT RE-SAMPLED DUE TO UTILITY PROXIMITY.

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-01-A	SED-01-A/0-6	0-0.5	12/20/2002	Acenaphthylene	0.06
				Anthracene	0.09
				Benzo(a)anthracene	0.31
				Benzo(ghi)perylene	0.42
				bis(2-Ethylhexyl)phthalate	6.5
				Dibenz(a,h)anthracene	0.1
				Fluoranthene	0.64
				Fluorene	0.02
				Indeno(1,2,3-cd)pyrene	0.36
				Pyrene	0.72
				Total PAHs	4.3
SED-01-B	SED-01-B/0-6	0-0.5	12/20/2002	Acenaphthene	0.08
				Acenaphthylene	0.06
				Anthracene	0.2
				Benzo(a)pyrene	0.86
				Benzo(a)anthracene	0.61
				Benzo(ghi)perylene	0.87
				Benzo(k)fluoranthene	0.36
				bis(2-Ethylhexyl)phthalate	3.2
				Chrysene	0.91
				Dibenz(a,h)anthracene	0.21
				Fluoranthene	1
				Fluorene	0.07
				Indeno(1,2,3-cd)pyrene	0.64
				Phenanthrene	0.61
				Pyrene	1.3
				Total PAHs	8.86
	SED-01-B/2.0-2.5	2-2.5	9/25/2019	Anthracene	0.47
				Benzo(a)pyrene	0.69
				Benzo(a)anthracene	0.83
				Benzo(ghi)perylene	0.64
				Benzo(k)fluoranthene	0.43
				bis(2-Ethylhexyl)phthalate	8.6
				Chrysene	1.2
				Dibenz(a,h)anthracene	0.18
				Fluoranthene	2
				Indeno(1,2,3-cd)pyrene	0.4
				2-Methylnaphthalene	0.08 J
				Phenanthrene	0.35
				Pyrene	2
				Total PAHs	10.2
SED-01-C	SED-01-C/0-6	0-0.5	12/20/2002	Acenaphthene	0.08
				Acenaphthylene	0.17
				Anthracene	0.5
				Benzo(a)anthracene	0.59
				Benzo(ghi)perylene	0.2
				Chrysene	1.2
				Fluoranthene	1.3
				Fluorene	0.1
				Phenanthrene	0.29
				Pyrene	2.6
				Total PAHs	8
SED-02-A	SED-02-A/0-6	0-0.5	12/20/2002	Acenaphthene	0.03 J
				Acenaphthylene	0.11
				Anthracene	0.24
				Benzo(a)pyrene	0.78
				Benzo(a)anthracene	0.55
				Benzo(ghi)perylene	0.76
				Benzo(k)fluoranthene	0.4
				bis(2-Ethylhexyl)phthalate	4.3
				Butyl benzyl phthalate	0.25 J
				Chrysene	0.83
				Dibenz(a,h)anthracene	0.17
				Fluoranthene	1.3
				Fluorene	0.05 J
				Indeno(1,2,3-cd)pyrene	0.58
				Phenanthrene	0.33
				Pyrene	1.6
				Total PAHs	9.1

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-02-A(R)	SED-02-A(R)/0.0-0.5	0-0.5	9/27/2019	Benzo(a)pyrene	0.45
				Benzo(a)anthracene	0.36
				Benzo(ghi)perylene	0.39
				bis(2-Ethylhexyl)phthalate	0.56 J
				Dibenz(a,h)anthracene	0.072 J
				Indeno(1,2,3-cd)pyrene	0.28
				Total PAHs	4.044
	SED-02-A(R)/6.0-6.5	6-6.5	9/27/2019	Acenaphthene	0.81
				Anthracene	1.3
				Benzo(a)pyrene	0.51
				Benzo(a)anthracene	0.89
				Benzo(ghi)perylene	0.3
				Chrysene	1
				Dibenz(a,h)anthracene	0.098 J
				Fluoranthene	1.6
				Fluorene	1.3
				Indeno(1,2,3-cd)pyrene	0.25
				2-Methylnaphthalene	3.5
				Naphthalene	0.72
				Phenanthrene	4.2
				Pyrene	2.2
				Total PAHs	19.56
SED-02-B	SED-02-B/0-6	0-0.5	12/20/2002	Acenaphthene	0.45
				Acenaphthylene	0.046 J
				Anthracene	1.3
				Benzo(a)pyrene	2.2
				Benzo(a)anthracene	2.1
				Benzo(b)fluoranthene	2.6
				Benzo(ghi)perylene	1.6
				Benzo(k)fluoranthene	0.99
				bis(2-Ethylhexyl)phthalate	2.1
				Chrysene	2.3
				Dibenz(a,h)anthracene	0.34
				Fluoranthene	4.8
				Fluorene	0.5
				Indeno(1,2,3-cd)pyrene	1.4
				2-Methylnaphthalene	0.15
				Naphthalene	0.19
				Phenanthrene	4.9
				Pyrene	5.1
				Total PAHs	30.97
	SED-02-B/0-6(D)	0-0.5	12/20/2002	Acenaphthene	0.068
				Acenaphthylene	0.057 J
				Anthracene	0.47
				Benzo(a)pyrene	0.97
				Benzo(a)anthracene	1
				Benzo(ghi)perylene	0.64
				Benzo(k)fluoranthene	0.48
				bis(2-Ethylhexyl)phthalate	1
				Chrysene	1.4
				Dibenz(a,h)anthracene	0.17
				Fluoranthene	2.2
				Fluorene	0.14
				Indeno(1,2,3-cd)pyrene	0.55
				Phenanthrene	1.7
				Pyrene	2.3
				Total PAHs	13.48
SED-02-B(R)	SED-02-B(R)/0.0-0.5(A)	0-0.5	9/27/2019	Anthracene	0.096 J
				Benzo(a)pyrene	0.44
				Benzo(a)anthracene	0.37
				Benzo(ghi)perylene	0.48
				bis(2-Ethylhexyl)phthalate	0.82 J
				Dibenz(a,h)anthracene	0.08 J
				Indeno(1,2,3-cd)pyrene	0.27
				Pyrene	0.79
				Total PAHs	4.561
	SED-02-B(R)/0.0-0.5(B)	0-0.5	9/27/2019	Anthracene	0.11 J
				Benzo(a)pyrene	0.68
				Benzo(a)anthracene	0.48
				Benzo(ghi)perylene	0.93
				Benzo(k)fluoranthene	0.26
				bis(2-Ethylhexyl)phthalate	1.9
				Chrysene	0.66
				Dibenz(a,h)anthracene	0.16
				Fluoranthene	0.62
				Indeno(1,2,3-cd)pyrene	0.37
				Phenanthrene	0.26
				Pyrene	1.1
				Total PAHs	6.464
	SED-02-B(R)/3.5-4.0	3.5-4	9/27/2019	Acenaphthene	0.045 J
				Fluorene	0.093 J
				2-Methylnaphthalene	0.3 J

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-02-C	SED-02-C/0-6	0-0.5	12/20/2002	Acenaphthene	0.037 J
				Acenaphthylene	0.11
				Anthracene	0.22
				Benzo(a)pyrene	1.4
				Benzo(a)anthracene	0.65
				Benzo(ghi)perylene	1.5
				Benzo(k)fluoranthene	0.48
				bis(2-Ethylhexyl)phthalate	20
				Chrysene	1.4
				Dibenz(a,h)anthracene	0.37
				Fluoranthene	0.94
				Fluorene	0.037 J
				Indeno(1,2,3-cd)pyrene	0.75
				Pyrene	3.3
				Total PAHs	13.02
SED-02-C(R)	SED-02-C(R)/0.0-0.5	0-0.5	9/27/2019	bis(2-Ethylhexyl)phthalate	2.3
	SED-02-C(R)/2.0-2.5	2-2.5	9/27/2019	Acenaphthene	0.77
				Acenaphthylene	0.61
				Anthracene	2
				Benzo(a)pyrene	0.47
				Benzo(a)anthracene	0.75
				Benzo(ghi)perylene	0.37
				Benzo(k)fluoranthene	0.29
				Chrysene	1.8
				Dibenz(a,h)anthracene	0.09 J
				Fluoranthene	1.9
				Fluorene	0.82
				Indeno(1,2,3-cd)pyrene	0.24
				2-Methylnaphthalene	0.82
				Naphthalene	0.63
				Phenanthrene	4.2
				Pyrene	3.6
				Total PAHs	20.06
SED-19-B	SED-19-B	6-6.5	3/21/2014	Anthracene	3.55
				Aroclor 1248	2.57
				Aroclor 1254	4.01
				Benzo(a)pyrene	10.6
				Benzo(a)anthracene	7.03
				Benzo(b)fluoranthene	6.94
				Benzo(ghi)perylene	12.8
				Benzo(k)fluoranthene	0.882
				bis(2-Ethylhexyl)phthalate	7.01
				Chrysene	11.7
				4,4'-DDD	1.83
				4,4'-DDE	0.3
				DDT (Total)	2.132
				Dibenz(a,h)anthracene	2.92
				Fluoranthene	6.63
				Heptachlor epoxide	0.043
				Indeno(1,2,3-cd)pyrene	2.89
				2-Methylnaphthalene	14.5
				Naphthalene	3.12
				Phenanthrene	19.2
				Pyrene	13.1
				Total PAHs	115.9
				Total PCB (Aroclors)	6.58
	SED-19-B/0.0-0.5	0-0.5	9/20/2019	Anthracene	0.57 J
				Benzo(a)pyrene	2.2
				Benzo(a)anthracene	1.9
				Benzo(b)fluoranthene	2.6
				Benzo(ghi)perylene	1.8
				bis(2-Ethylhexyl)phthalate	6.4 J
				Chrysene	2.8
				Fluoranthene	3.1
				Indeno(1,2,3-cd)pyrene	1.2
				Phenanthrene	0.97 J
				Pyrene	3.7
				Total PAHs	20.84

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-19-C	SED-19-C	7.5-8	3/21/2014	Acenaphthene	1.26
				Anthracene	3.16
				Aroclor 1248	3.96
				Aroclor 1254	2.91
				Benzo(a)pyrene	6.24
				Benzo(a)anthracene	4.63
				Benzo(b)fluoranthene	3.91
				Benzo(ghi)perylene	5.08
				Benzo(k)fluoranthene	0.853
				bis(2-Ethylhexyl)phthalate	23.5
				Chlordane (alpha and gamma)	0.019
				Chrysene	6.96
				4,4'-DDD	0.056
				4,4'-DDE	0.104
				DDT (Total)	0.16
				Dibenz(a,h)anthracene	1.67
				Fluoranthene	5.1
				Fluorene	2.57
				Heptachlor	0.01
				Indeno(1,2,3-cd)pyrene	1.79
				2-Methylnaphthalene	14.9
				Naphthalene	4.06
				Phenanthrene	12.6
				Pyrene	12
				Total PAHs	86.78
				Total PCB (Aroclors)	6.87
	SED-19-C/0.0-0.5	0-0.5	9/20/2019	Benzo(a)anthracene	0.75 J
				Chrysene	0.8 J
				Fluoranthene	1.1 J
				Pyrene	1.4
				Total PAHs	4.98
SED-22-A	SED-22-A/2.0-2.5	2-2.5	9/25/2019	Naphthalene	0.47
SED-22-B	SED-22-B/0.0-0.5	0-0.5	9/25/2019	Anthracene	0.72
				Benzo(a)pyrene	0.96
				Benzo(a)anthracene	1.4
				Benzo(ghi)perylene	0.89
				Benzo(k)fluoranthene	0.45
				bis(2-Ethylhexyl)phthalate	48
				Chrysene	1.9
				Dibenz(a,h)anthracene	0.15 J
				Fluoranthene	2.5
				Indeno(1,2,3-cd)pyrene	0.55
				2-Methylnaphthalene	0.32 J
				Naphthalene	0.19 J
				Phenanthrene	0.41
				Pyrene	3.6
				Total PAHs	15.54
	SED-22-B/9.0-9.5	9-9.5	9/25/2019	Anthracene	0.41
				Benzo(a)anthracene	0.49
				Benzo(ghi)perylene	0.22
				Chrysene	0.82
				Fluoranthene	1.1
				Fluorene	0.67
				Indeno(1,2,3-cd)pyrene	0.23
				2-Methylnaphthalene	2.1
				Naphthalene	0.53
				Phenanthrene	1.8
				Pyrene	1.5
				Total PAHs	10.92
SED-22-C	SED-22-C/0.0-0.5	0-0.5	9/26/2019	bis(2-Ethylhexyl)phthalate	3.9
	SED-22-C/4.5-5.0	4.5-5	9/26/2019	Anthracene	0.48
				Benzo(a)anthracene	0.31
				Benzo(ghi)perylene	0.2
				bis(2-Ethylhexyl)phthalate	1.7
				Chrysene	0.46
				Fluoranthene	0.87
				Fluorene	0.76
				2-Methylnaphthalene	2.4
				Naphthalene	0.49
				Phenanthrene	1.7
				Pyrene	0.88
				Total PAHs	9.364

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-01-A	SED-01-A/0.0-0.5	0-0.5	9/23/2019	EPH, TOTAL FRACTIONATED	23
	SED-01-A/2.0-2.5	2-2.5	9/23/2019	EPH, TOTAL FRACTIONATED	8.7 J
SED-01-B	SED-01-B/0.0-0.5	0-0.5	9/25/2019	EPH, TOTAL FRACTIONATED	840
	SED-01-B/0.5-1.0	0.5-1	9/25/2019	EPH, TOTAL FRACTIONATED	1500
	SED-01-B/2.0-2.5	2-2.5	9/25/2019	EPH, TOTAL FRACTIONATED	1900
SED-01-C	SED-01-C/0.0-0.5	0-0.5	9/23/2019	EPH, TOTAL FRACTIONATED	1400
	SED-01-C/0.5-1.0	0.5-1	9/23/2019	EPH, TOTAL FRACTIONATED	8100
SED-02-A(R)	SED-02-A(R)	6-6.5	3/21/2014	EPH, TOTAL FRACTIONATED	####
	SED-02-A(R)/0.0-0.5	0-0.5	9/27/2019	EPH, TOTAL FRACTIONATED	350
	SED-02-A(R)/0.5-1.0	0.5-1	9/27/2019	EPH, TOTAL FRACTIONATED	26
SED-02-B(R)	SED-02-B(R)	3.5-4	3/21/2014	EPH, TOTAL FRACTIONATED	####
	SED-02-B(R)/0.0-0.5(A)	0-0.5	9/27/2019	EPH, TOTAL FRACTIONATED	780
	SED-02-B(R)/0.0-0.5(B)	0-0.5	9/27/2019	EPH, TOTAL FRACTIONATED	1200
	SED-02-B(R)/0.5-1.0	0.5-1	9/27/2019	EPH, TOTAL FRACTIONATED	2100
SED-02-C(R)	SED-02-C(R)/0.0-0.5	0-0.5	9/27/2019	EPH, TOTAL FRACTIONATED	1100
	SED-02-C(R)/0.5-1.0	0.5-1	9/27/2019	EPH, TOTAL FRACTIONATED	7000
	SED-02-C(R)/2.0-2.5	2-2.5	9/27/2019	EPH, TOTAL FRACTIONATED	####
SED-19-B	SED-19-B	6-6.5	3/21/2014	EPH, TOTAL FRACTIONATED	####
	SED-19-B/0.0-0.5	0-0.5	9/20/2019	EPH, TOTAL FRACTIONATED	3300
	SED-19-B/0.5-1.0	0.5-1	9/20/2019	EPH, TOTAL FRACTIONATED	2900
SED-19-C	SED-19-C	7.5-8	3/21/2014	EPH, TOTAL FRACTIONATED	8170
	SED-19-C/0.0-0.5	0-0.5	9/20/2019	EPH, TOTAL FRACTIONATED	2600
	SED-19-C/0.5-1.0	0.5-1	9/20/2019	EPH, TOTAL FRACTIONATED	2700
SED-22-A	SED-22-A/0.0-0.5	0-0.5	9/25/2019	EPH, TOTAL FRACTIONATED	69
SED-22-B	SED-22-B/0.0-0.5	0-0.5	9/25/2019	EPH, TOTAL FRACTIONATED	920
	SED-22-B/9.0-9.5	9-9.5	9/25/2019	EPH, TOTAL FRACTIONATED	####
SED-22-C	SED-22-C/0.0-0.5	0-0.5	9/26/2019	EPH, TOTAL FRACTIONATED	5300
	SED-22-C/4.5-5.0	4.5-5	9/26/2019	EPH, TOTAL FRACTIONATED	####

Parameter	ESC ER-L	ESC ER-M
Acenaphthene	0.016	0.5
Acenaphthylene	0.044	0.64
Anthracene	0.085	1.1
Aroclor 1248	0.03	--
Aroclor 1254	0.06	--
Benzo(a)pyrene	0.43	1.6
Benzo(a)anthracene	0.261	1.6
Benzo(b)fluoranthene	--	1.8
Benzo(ghi)perylene	0.17	--
Benzo(k)fluoranthene	0.24	--
bis(2-Ethylhexyl)phthalate	0.18216	2.64651
Butyl benzyl phthalate	--	0.063
Chlordane (alpha and gamma)	0.007	--
Chrysene	0.384	2.8
4,4'-DDD	0.002	0.02
4,4'-DDE	0.0022	0.027
DDT (Total)	0.0016	0.046
Dibenz(a,h)anthracene	0.063	0.26
EPH, TOTAL FRACTIONATED	--	--
Fluoranthene	0.6	5.1
Fluorene	0.019	0.54
Heptachlor	--	0.0003
Heptachlor epoxide	0.005	--
Indeno(1,2,3-cd)pyrene	0.2	--
2-Methylnaphthalene	0.07	0.67
Naphthalene	0.16	2.1
Phenanthrene	0.24	1.5
Pyrene	0.665	2.6
Total PAHs	4	45
Total PCB (Aroclors)	0.023	0.18

Note:
ESC = NJDEP Ecological Screening Criteria, March 2009
ESC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)
ESC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
Bold indicates concentrations above the ESC ER-L
Underline indicates concentrations above the ESC ER-M
ND = Not Detected
NA = Not Analyzed
J = Estimated value below sample reporting limit
MDL = Method Detection Limit
U = Compound not detected above MDL
Values in italics indicate MDL above applicable criterion.
All concentrations are in milligrams per kilogram (mg/kg).
Only constituents with concentrations above the referenced standard or criteria are presented.

PROJECT:
SEDIMENT INVESTIGATION REPORT
CHEVRON FACILITY
PERTH AMBOY, NEW JERSEY

TITLE:
SEDIMENT ANALYTICAL RESULTS - SVOCs/EPH
WOODBRIDGE CREEK - LOWER REACH

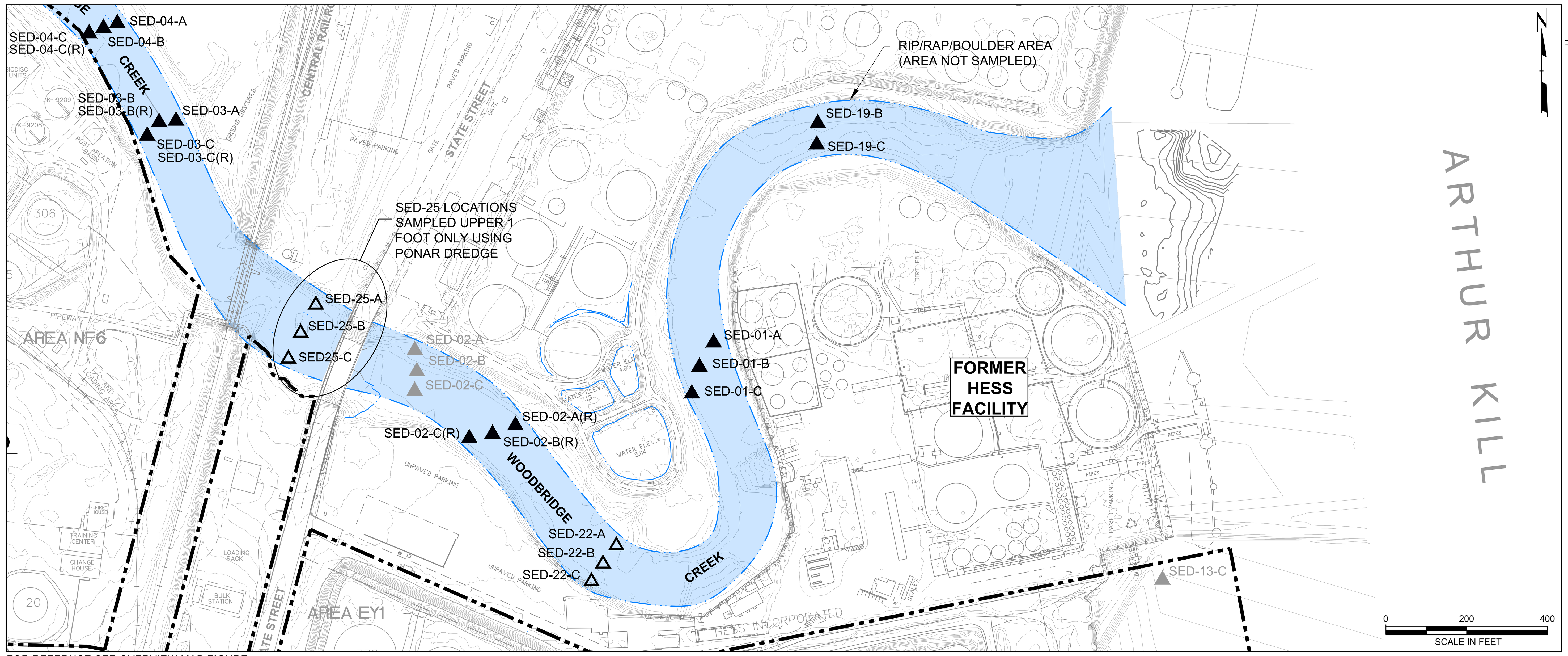
DRAWN BY:	M. GIAMBATTISTA	PROJ. NO.:	326731.2020.0000
CHECKED BY:	W. CORDASCO		FIGURE 10
APPROVED BY:	R. LIPPENCOTT		
DATE:	FEBRUARY 2020		

TRC

41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: BathymetricTransect figures_DATA.dwg

DRAWING NAME: M:\Cad Files\WORK\890\2019\Bathymetric\Final\ BathymetricTransect figures_DATA.dwg --- PLOT DATE: May 15, 2020 - 9:45AM --- LAYOUT: LOW SVOC
XREF'S: -- ATTACHED IMAGES: J8A14; J8A13; J8A14; J8A15; J8C1; J8C2; J8C3; J8C5; J8C6; J8C7;
Version: 2017-10-21

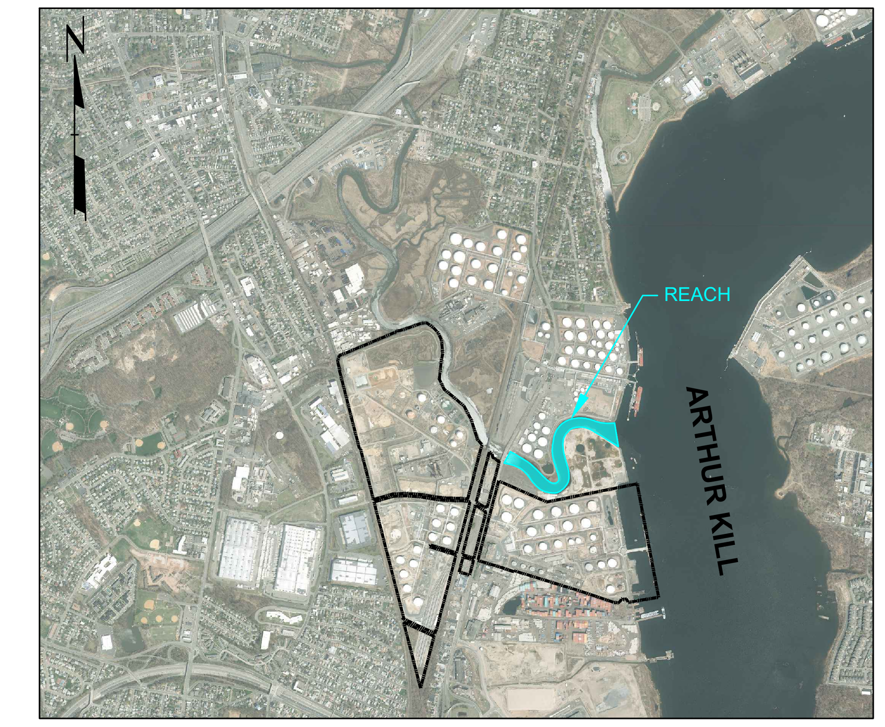


FOR REFERNCE SEE OVERVIEW MAP FIGURE ....

PLAN VIEW

LEGEND

- FORMER CHEVRON PERTH AMBOY FACILITY BOUNDARY
- WATER FEATURE BOUNDARY (APPROXIMATE)
- △ SEDIMENT SAMPLE LOCATION SAMPLED IN 2019 (ADDED PER SUPPLEMENTARY FIELD SAMPLING AND ANALYSIS WORKPLAN [2019])
- ▲ PREVIOULSY SAMPLED LOCATION REVISITED IN 2019
- ▲ SEDIMENT SAMPLE LOCATIONS 2002 (NOT SUBSEQUENTLY SAMPLED)



KEYMAP
SCALE: 1"=2500'

NOTES:

1. TOP OF BANK ELEVATIONS ARE APPROXIMATE BASED ON EXISTING ESRI AERIAL IMAGERY ACCESSED 9/18/2019.
2. TOPOGRAPHY DERIVED FROM NJDEP DEM RASTER PROJECTION (GIS) (DATED - 2017).
3. SEDIMENT STRATA INCLUDE MINOR COMPONENTS (E.G. SHELLS; TRACES OF OTHER MATERIAL [SAND, GRAVEL..]) NOT DETAILED HERE.
4. SED-02-A,B,C NOT RE-SAMPLED DUE TO UTILITY PROXIMITY.

Location ID	Field ID	Depth	Date	Parameter	Concentration (mg/kg)
SED-01-A	SED-01-A/0-6	0-0.5	12/20/2002	Aluminum	20900
				Arsenic	**32.1**
				Barium	123
				Cadmium	**3.7** J
				Chromium	**121**
				Cobalt	20
				Copper	**758**
				Lead	**264**
				Manganese	368
				Mercury	**3.4**
				Nickel	**104**
				Selenium	6.3
				Silver	**4.9** J
				Vanadium	64.6
				Zinc	**488**
	SED-01-A/2.0-2.5	2-2.5	9/23/2019	Aluminum	31400
				Arsenic	**23.4**
				Barium	78.9
				Cobalt	13.5
				Copper	**39.8**
				Manganese	669
				Nickel	**38.1**
				Vanadium	73.1
SED-01-B	SED-01-B/0-6	0-0.5	12/20/2002	Arsenic	**17.3**
				Barium	66.9
				Cadmium	**1.8** J
				Copper	**424**
				Lead	**142**
				Mercury	**1.3**
				Nickel	**54.7**
				Selenium	6.7
				Silver	**1.5** J
				Zinc	**289**
	SED-01-B/2.0-2.5	2-2.5	9/25/2019	Arsenic	**28.4**
				Barium	106
				Cadmium	**3.53**
				Chromium	**89.8**
				Cobalt	27.2
				Copper	**2280**
				Lead	**402**
				Mercury	**2.97**
				Nickel	**159**
				Selenium	10.1
				Silver	**2.84**
				Vanadium	62.6
				Zinc	**763**
SED-01-C	SED-01-C/0-6	0-0.5	12/20/2002	Aluminum	30400
				Arsenic	**63**
				Barium	137
				Cadmium	**2.7** J
				Cobalt	14.6
				Copper	**210**
				Lead	**137**
				Manganese	429
				Mercury	**0.97** J
				Nickel	**45**
				Selenium	4.3
				Silver	**1.3** J
				Vanadium	67.1
				Zinc	**218**
	SED-01-C/2.0-2.5	2-2.5	9/23/2019	Aluminum	29600
				Arsenic	**20.8**
				Barium	73.4
				Cobalt	13.1
				Copper	**47.7**
				Manganese	408
				Mercury	**0.163** J
				Nickel	**31.3**
				Vanadium	62.1
SED-02-A	SED-02-A/0-6	0-0.5	12/20/2002	Aluminum	19200
				Arsenic	**23.1**
				Barium	108
				Cadmium	**3.7** J
				Chromium	**94.7**
				Cobalt	15
				Copper	**564**
				Lead	**227**
				Manganese	306
				Mercury	**2.4**
				Nickel	**81.3**
				Selenium	5.6
				Silver	**3.7** J
				Vanadium	61.9
				Zinc	**483**
SED-02-A(R)	SED-02-A(R)/0.0-0.5	0-0.5	9/27/2019	Copper	**227**
				Lead	**129**
				Mercury	**0.315**
				Nickel	**48.2**
				Selenium	22.6
				Silver	**1.09** J
	SED-02-A(R)/6.0-6.5	6-6.5	9/27/2019	Aluminum	21200
				Antimony	12.5
				Arsenic	**101**
				Barium	313
				Cadmium	**2.02**
				Chromium	**87.1**
				Cobalt	11.5
				Copper	**660**
				Lead	**301**
				Manganese	387
				Mercury	***2.58***
				Nickel	**70.7**
				Selenium	13.4
				Silver	**2.14**
				Zinc	**453**
SED-02-B	SED-02-B/0-6	0-0.5	12/20/2002	Arsenic	**9.9**
				Copper	**213**
				Lead	**54**
				Mercury	**0.28**
				Nickel	**30.7**
				Selenium	2.1
				Zinc	**164**
	SED-02-B/0-6(D)	0-0.5	12/20/2002	Arsenic	**10.9**
				Barium	57.4
				Copper	**172**
				Lead	**50.9**
				Mercury	**0.36**
				Nickel	**29.2**
				Selenium	2.2
SED-02-B(R)	SED-02-B(R)/0.0-0.5(A)	0-0.5	9/27/2019	Arsenic	**11.8**
				Copper	**266**
				Lead	**92.6**
				Mercury	**0.508**
				Nickel	**45.4**
				Selenium	2.6 J
				Silver	**1.5**
				Zinc	**216**
	SED-02-B(R)/0.0-0.5(B)	0-0.5	9/27/2019	Arsenic	**12.7**
				Copper	**288**
				Lead	**121**
				Mercury	**0.501**
				Nickel	**55.1**
				Selenium	7.93
				Zinc	**245**
	SED-02-B(R)/3.5-4.0	3.5-4	9/27/2019	Arsenic	**43.2**
				Barium	133
				Cobalt	13.6
				Copper	**129**
				Lead	**82.4**
				Manganese	556
				Mercury	**1.1**
				Nickel	**37**
				Zinc	**172**
SED-02-C	SED-02-C/0-6	0-0.5	12/20/2002	Aluminum	19500
				Arsenic	**54.4**
				Barium	200
				Cadmium	**9.5**
				Chromium	**119**
				Cobalt	17.1
				Copper	**763**
				Lead	**291**
				Mercury	**4.3**
				Nickel	**143**
				Selenium	25.1
				Silver	**4.1**
				Vanadium	87.9
				Zinc	**535**
SED-02-C(R)	SED-02-C(R)/0.0-0.5	0-0.5	9/27/2019	Aluminum	18700
				Arsenic	**24.9**
				Barium	110
				Cadmium	**3.51**
				Chromium	**90.7**
				Cobalt	26.9
				Copper	**1780**
				Lead	**217**
				Manganese	267
				Mercury	***1.92***
				Nickel	**297**
				Selenium	3.69 J
				Silver	**5.71**
				Zinc	**696**
	SED-02-C(R)/2.0-2.5	2-2.5	9/27/2019	Aluminum	23800
				Antimony	16.7
				Arsenic	**141**
				Barium	381
				Cadmium	**4.76**
				Chromium	**116**
				Cobalt	10.8
				Copper	**753**
				Lead	**426**
				Mercury	***5.59***
				Nickel	**48**
				Selenium	8.45 J
				Silver	**5.84**
				Vanadium	63.3
				Zinc	**669**
SED-19-B	SED-19-B	6-6.5	3/21/2014	Antimony	9.5
				Arsenic	**47.6**
				Barium	161
				Cadmium	**5.6**
				Cobalt	11
				Copper	**447**
				Lead	**817**
				Mercury	**1.7**
				Nickel	**91.7**
				Selenium	18.4
				Silver	**1.1**
				Vanadium	59.8
				Zinc	**476**
	SED-19-B/0.0-0.5	0-0.5	9/20/2019	Arsenic	**23.9**
				Barium	92.5
				Cadmium	**3.24**
				Cobalt	15.7
				Copper	**689**
				Lead	**249**
				Mercury	***1.96***
				Nickel	**128**
				Selenium	11.4
				Silver	**1.56** J
				Zinc	**563**
SED-19-C	SED-19-C	7.5-8	3/21/2014	Arsenic	**62.3**
				Barium	213
				Cadmium	**10**
				Chromium	**99.1**
				Copper	**337**
				Lead	**166**
				Mercury	**7.1**
				Nickel	**53.1**
				Selenium	27.2
				Silver	**2**
				Vanadium	59.3
				Zinc	**375**
	SED-19-C/0.0-0.5	0-0.5	9/20/2019	Arsenic	**24.2**
				Barium	107
				Cadmium	**4.74**
				Chromium	**105**
				Cobalt	16
				Copper	**1090**
				Lead	**251**
				Mercury	**2.47**
				Nickel	**130**
				Selenium	6.55 J
				Silver	**4.49**
				Vanadium	60.7
				Zinc	**633**
SED-22-A	SED-22-A/0.0-0.5	0-0.5	9/25/2019	Aluminum	35600
				Arsenic	**49.5**
				Barium	87.9
				Cobalt	13.2
				Copper	**126**
				Lead	**84**
				Manganese	394
				Mercury	**0.267** J
				Nickel	**40.8**
				Selenium	8.81
				Vanadium	64.1
				Zinc	**167**
	SED-22-A/2.0-2.5	2-2.5	9/25/2019	Aluminum	23600
				Arsenic	**17.3**
				Barium	59.5
				Cobalt	12
				Manganese	374
				Nickel	**26.3**
				Selenium	6.23 J
				Vanadium	58.9
SED-22-B	SED-22-B/0.0-0.5	0-0.5	9/25/2019	Aluminum	23200
				Arsenic	**61.2**
				Barium	220
				Cadmium	**11.8**
				Chromium	**178**
				Cobalt	33.2
				Copper	**2130**
				Lead	**242**
				Mercury	***7.5***
				Nickel	**567**
				Selenium	139
				Silver	**4.73**
				Vanadium	82.1
				Zinc	**630**
	SED-22-B/9.0-9.5	9-9.5	9/25/2019	Aluminum	22000
				Antimony	16.1
				Arsenic	**217**
				Barium	407
				Cadmium	**5.04**
				Chromium	**230**
				Cobalt	11.6
				Copper	**816**
				Lead	**481**
				Manganese	299
				Mercury	***8.62***
				Nickel	**42**
				Selenium	18.8
				Silver	**7.04**
				Vanadium	87
				Zinc	**630**
SED-22-C	SED-22-C/0.0-0.5	0-0.5	9/26/2019	Aluminum	31300
				Arsenic	**56.7**
				Barium	173
				Cadmium	**4.82**
				Chromium	**108**
				Cobalt	33.4
				Copper	**1200**
				Lead	**269**
				Manganese	342
				Mercury	***7.1***
				Nickel	**142**
				Selenium	31.6
				Silver	***5.08***
				Vanadium	92.7
				Zinc	**629**
	SED-22-C/4.5-5.0	4.5-5	9/26/2019	Aluminum	24700
				Arsenic	**150**
				Barium	299
				Cadmium	**5.47**
				Chromium	**193**
				Cobalt	12.4
				Copper	**563**
				Lead	**483**
				Manganese	374
				Mercury	***5.56***
				Nickel	**48.8**
				Selenium	8.84 J
				Silver	**6.63**
				Vanadium	73.3
				Zinc	**562**

Parameter	ESC ER-L	ESC ER-M
Aluminum	--	18000
Antimony	--	9.3
Arsenic	8.2	70
Barium	--	48
Cadmium	1.2	9.6
Chromium	81	370
Cobalt	--	10
Copper	34	270
Lead	47	218
Manganese	--	260
Mercury	0.15	0.71
Nickel	21	52
Selenium	--	1
Silver	1	3.7
Vanadium	--	57
Zinc	150	410

Note:
ESC = NJDEP Ecological Screening Criteria, March 2009
ESC ER-L = Saline Water Sediment Effects Range Low (per NJDEP ESC)
ESC ER-M = Saline Water Sediment Effects Range Medium (per NJDEP ESC)
Bold indicates concentrations above the ESC ER-L
Underline indicates concentrations above the ESC ER-M
ND = Not Detected
NA = Not Analyzed
J = Estimated value below sample reporting limit
MDL = Method Detection Limit
U = Compound not detected above MDL
Values in italics indicate MDL above applicable criterion.
All concentrations are in milligrams per kilogram (mg/kg).
Only constituents with concentrations above the referenced standard or criteria are presented.

PROJECT: SEDIMENT INVESTIGATION REPORT
CHEVRON FACILITY
PERTH AMBOY, NEW JERSEY

TITLE: SEDIMENT ANALYTICAL RESULTS - METALS
WOODBRIDGE CREEK - LOWER REACH

DRAWN BY:	M. GIAMBATTISTA	PROJ. NO.:	326731.2020.0000
CHECKED BY:	W. CORDASCO	FIGURE 11	
APPROVED BY:	R. LIPPENCOTT		
DATE:	FEBRUARY 2020		

41 Spring Street
Suite 102
New Providence, NJ 07974
Phone: 908.988.1700

FILE NO.: BathymetricTransect figures_DATA.dwg

24x36 --- USER: LBochkis --- ATTACHED XREFS: --- ATTACHED IMAGES: J8A14; J8A13; J8A14; J8A15; J8C1; J8C2; J8C3; J8C5; J8C6; J8C7;
DRAWING NAME: M:\Cad Files\WORK\890\2019\Bathymetric\Final\ BathymetricTransect figures_DATA.dwg --- PLOT DATE: May 15, 2020 - 9:47AM --- LAYOUT: LOW METALS
Version: 2017-10-21

Table 1 - Sample Summary Table
Spa Spring Creek and Woodbridge Creek Sediments
Former Perth Amboy Chevron Facility
Perth Amboy, New Jersey - May 18, 2020

Sample ID	SP X	SP Y	Date Sampled	Sample Depth[1]	Analysis	Lab ID	Waterway
SED-WCBG-1[2]	557030.82	626550.26	10/15/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1175345, 1175345DL	Woodbridge Creek Background
				0.5-1.0	EPH and VOCs	1175346, 1175346DL	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1175347	
SED-WCBG-2[2]	557010.11	626557.14	10/18/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1178618	Woodbridge Creek Background
				0.5-1.0	EPH and VOCs	1178619	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1178620	
SED-WCBG-3[2]	556985.59	626565.48	10/15/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1175341	Woodbridge Creek Background
				0.5-1.0	EPH and VOCs	1175342, 1175343	
				2.5-3.0	EPH, VOCs, SVOCs, Metals	1175344	
SED-WCBG-4[2]	557005.45	626500.38	10/16/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1176398	Woodbridge Creek Background
				0.5-1.0	EPH and VOCs	1176399	
				1.0-1.5	EPH, VOCs, SVOCs, Metals	1176400	
SED-WCBG-5[2]	556986.40	626511.52	10/18/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1178614	Woodbridge Creek Background
				0.5-1.0	EPH and VOCs	1178615	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1178616, 1178617	
SED-WCBG-6[2]	556955.84	626525.61	10/16/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1176401	Woodbridge Creek Background
				0.5-1.0	EPH and VOCs	1176402, 1176402DL	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1176403, 1176403DL	
SED-WCBG-7[2]	556986.93	626458.05	10/16/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1176394	Woodbridge Creek Background
				0.5-1.0	EPH and VOCs	1176395, 1176396	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1176397	
SED-WCBG-8[2]	556939.36	626480.27	10/18/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1178611, 1178611DL	Woodbridge Creek Background
				0.5-1.0	EPH and VOCs	1178612	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1178613	
SED-01-A	559393.98	621287.52	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967881	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	3967880	
			9/23/2019	0.0-0.5	EPH	1157565	
				0.5-1.0	EPH	1157566	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1157567	
SED-01-B	559357.55	621226.70	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967883	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	3967882	
			9/25/2019	0.0-0.5	EPH	1159743	
				0.5-1.0	EPH	1159744	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1159745	

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SED-01-C	559340.94	621162.46	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967905	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	3967904	
			9/23/2019	0.0-0.5	EPH	1157562	
				0.5-1.0	EPH	1157563, 1157563DL	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1157564	
SED-02-A	558650.96	621265.12	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967892	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	3967891	
SED-02-A(R)	558903.66	621082.12	3/21/2014	6.0-6.5	Grain Size, TOC, pH, EPH	JB62621-2	
			9/27/2019	0.0-0.5	EPH, SVOCs, Metals	1162106	
				0.5-1.0	EPH and VOCs	1162107	
				6.0-6.5	SVOCs, Metals, VOCs	1162108	
SED-02-B	558659.16	621216.62	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967889	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	3967887, 3967888	
SED-02-B(R)	558846.28	621061.44	3/21/2014	3.5-4.0	Grain Size, TOC, pH, EPH	JB62621-1	
			9/27/2019	0.0-0.5	EPH, SVOCs, Metals	1162109, 1162110	
				0.5-1.0	EPH and VOCs	1162111, 1162111DL	
				3.5-4.0	SVOCs, Metals, VOCs	1162112	
SED-02-C	558654.00	621166.77	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967894	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	3967893	
SED-02-C(R)	558792.69	621051.42	9/27/2019	0.0-0.5	EPH, SVOCs, Metals	1162103	
				0.5-1.0	EPH and VOCs	1162104, 1162104DL	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1162105	
SED-03-A	558062.87	621835.71	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967919	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967918	
			9/30/2019	0.0-0.5	EPH	1163616	
				0.5-1.0	EPH	1163617, 1163617DL	
				6.0-6.5	EPH, SVOCs, Metals, VOCs	1163618, 1163618DL	
SED-03-B	558021.55	621831.25	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967857	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967856	
SED-03-B(R)	558020.76	621831.97	3/20/2014	1.5-2.0	Grain Size, TOC, pH EPH	JB62513-7	
				4.5-5.0	Grain Size, TOC, pH EPH	JB62513-8	
			9/30/2019	0.0-0.5	EPH	1163619	
				0.5-1.0	EPH	1163620	
				1.5-2.0	SVOCs, Metals, VOCs	1163621	
				4.5-5.0	SVOCs, Metals, VOCs	1163622	

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Sample ID	SP X	SP Y	Date Sampled	Sample Depth[1]	Analysis	Lab ID	Waterway
SED-03-C	557992.06	621797.86	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967921	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967920	
				1.0-1.5	VOCs, SVOCs, Metals, Grain Size, TOC, pH	3967922	
				2.5-3.0	VOCs, SVOCs, Metals, Grain Size, pH, TOC	3967923	
SED-03-C(R)	557992.66	621798.64	3/20/2014	1.5-2.0	EPH, Grain Size, pH, TOC	JB62513-5	
				6.0-6.5	EPH, Grain Size, TOC, pH	JB62513-6	
			9/30/2019	0.0-0.5	EPH	1163610	
				0.5-1.0	EPH	1163611	
				1.0-1.5	EPH	1163612	
				1.5-2.0	SVOCs, Metals, VOCs	1163613	
				2.5-3.0	EPH	1163614, 1163614DL	
				6.0-6.5	SVOCs, Metals, VOCs	1163615	
SED-04-A	557917.77	622076.90	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967911	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967910	
				3.25-3.75	VOCs and SVOCs	3967912, 3967913	
			10/1/2019	0.0-0.5	EPH	1164537	
				0.5-1.0	EPH	1164538, 1164538DL	
				3.25-3.75	EPH, Metals	1164539, 1164539DL	
SED-04-B	557883.74	622064.54	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967915	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967914	
			10/1/2019	0.0-0.5	EPH	1164536	
				0.5-1.0	EPH	1164535	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1164533, 1164534	
SED-04-C	557848.70	622050.78	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967917	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967916	
SED-04-C(R)	557848.70	622050.78	3/20/2014	1.5-2.0	Grain Size, TOC, pH, EPH	JB62513-14	
			10/1/2019	0.0-0.5	EPH	1164529	
				0.5-1.0	EPH	1164530	
				1.5-2.0	SVOCs, Metals, VOCs	1164531, 1164531DL	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1164532	
SED-05-A	557676.44	622300.69	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967907	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967906	
			10/1/2019	0.0-0.5	EPH	1164543	
				0.5-1.0	EPH	1164544	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1164545, 1164545DL	

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SED-05-B	557636.94	622305.06	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967909	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967908	
			10/1/2019	0.0-0.5	EPH	1164540	
				0.5-1.0	EPH	1164541	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1164542	
SED-05-C	557597.32	622284.30	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967855	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967854	
			10/1/2019	0.0-0.5	EPH	1164546	
				0.5-1.0	EPH	1164547, 1164547DL	
				6.0-6.5	EPH, SVOCs, Metals, VOCs	1164548, 1164548DL	
SED-06-A	557573.81	622802.95	12/19/2002	0.0-0.5	SVOCs, Metals, pH, TOC	3967875	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967874	
			10/2/2019	0.0-0.5	EPH and Grain Size	1165584, 1165584DL	
				0.5-1.0	EPH	1165585, 1165585DL	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1165586	
SED-06-B	557534.60	622794.45	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967879	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967878	
SED-06-B(R)	557546.33	622834.32	3/20/2014	4.0-4.5	Grain Size, TOC, pH, EPH	JB62513-3	
			1/2/2019	0.0-0.5	EPH	1165587	
				0.5-1.0	EPH	1165588	
				4.0-4.5	SVOCs, Metals, VOCs	1165589	
SED-06-C	557489.33	622802.44	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967867	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967866	
			10/2/2019	0.0-0.5	EPH	1165580	
				0.5-1.0	EPH	1165581, 1165581DL	
				4.0-4.5	EPH, SVOCs, Metals, VOCs	1165582, 1165582DL, 1165583	
SED-07-A	556561.63	623196.39	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967897	Spa Spring Creek Site Reach
				0.5-1.0	VOCs	3967896	
			10/16/2019	0.0-0.5	EPH	1176391	
				0.5-1.0	EPH	1176392	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1176393	
SED-07-B	556572.32	623191.87	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967859	Spa Spring Creek Site Reach
				0.5-1.0	VOCs	3967858	
			10/14/2019	0.0-0.5	EPH	1174536	
				0.5-1.0	EPH	1174537	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1174538	

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Sample ID	SP X	SP Y	Date Sampled	Sample Depth[1]	Analysis	Lab ID	Waterway
SED-07-C	556568.13	623179.05	12/20/2002	0.0-0.5	SVOCs, Metals, pH, TOC	3967901	Spa Spring Creek Site Reach
				0.5-1.0	VOCs	3967900	
			10/16/2019	0.0-0.5	EPH and Grain Size	1176388	
				0.5-1.0	EPH	1176389	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1176390	
SED-08-A	555973.66	622944.27	12/20/2002	0.0-0.5	SVOCs, Metals, pH, TOC	3967903	Spa Spring Creek Site Reach
				0.5-1.0	VOCs	3967902	
			10/14/2019	0.0-0.5	EPH and Grain Size	1174529	
				0.5-1.0	EPH	1174530	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1174531, 1174532	
SED-08-C	555981.49	622931.43	12/20/2002	0.0-0.5	SVOCs, Metals, pH, TOC	3967885	Spa Spring Creek Site Reach
				0.5-1.0	VOCs	3967884	
			10/14/2019	0.0-0.5	EPH and Grain Size	1174533	
				0.5-1.0	EPH	1174534	
				3.0-3.5	EPH, SVOCs, Metals, VOCs	1174535	
SED-09-A	556504.25	623995.19	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967877	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967876	
SED-09-A(R)	556504.25	623995.19	3/20/2014	3.0-3.5	EPH, Grain Size, TOC, pH	JB62513-1	
			10/7/2019	0.0-0.5	EPH	1169337	
				0.5-1.0	EPH	1169338, 1169338DL	
				3.0-3.5	SVOCs, Metals, VOCs	1169339	
SED-09-B	556454.62	623980.23	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967869	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967868	
			10/7/2019	0.0-0.5	EPH	1169334	
				0.5-1.0	EPH	1169335	
				5.0-5.5	EPH, SVOCs, Metals, VOCs	1169336, 1169336DL	
SED-09-C	556428.44	624018.74	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967864	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	3967863	
				2.75-3.25	SVOCs, VOCs, Metals, Grain Size, pH, TOC	3967865	
SED-09-C(R)	556428.44	624018.74	3/20/2014	4.5-5.0	Grain Size, TOC, pH, EPH	JB62513-2	
			10/16/2019	0.0-0.5	EPH	1176384	
				0.5-1.0	EPH	1176385	
				2.75-3.25	EPH	1176386, 1176386DL	
				4.5-5.0	SVOCs, Metals, VOCs	1176387	

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Spa Spring Creek and Woodbridge Creek Sediments
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Sample ID	SP X	SP Y	Date Sampled	Sample Depth[1]	Analysis	Lab ID	Waterway
SED-10-A	557052.84	626594.91	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967871	Woodbridge Creek Background
				0.5-1.0	VOCs	3967870	
			10/15/2019	0.0-0.5	EPH	1175348, 1175348DL	
				0.5-1.0	EPH	1175349	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1175350	
SED-10-B	557028.52	626598.80	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967873	Woodbridge Creek Background
				0.5-1.0	VOCs	3967872	
			10/15/2019	0.0-0.5	EPH	1175351	
				0.5-1.0	EPH	1175352	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1175353	
SED-10-C	557004.43	626603.32	12/19/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967862	Woodbridge Creek Background
				0.5-1.0	VOCs	3967861	
			10/15/2019	0.0-0.5	EPH	1175338	
				0.5-1.0	EPH	1175339	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1175340	
SED-11-C	555833.73	622656.21	12/20/2002	0.0-0.5	SVOCs, Metals, Grain Size, pH, TOC	3967899	Spa Spring Creek Site Reach
				0.5-1.0	VOCs	3967898	
			10/8/2019	0.0-0.5	EPH	1170576	
				0.5-1.0	EPH	1170575	
				2.0-2.5	EPH, SVOCs, Metals, VOCs	1170577	
SED-13-C	560503.50	620699.86	12/17/2002	0.0-0.5	VOCs, SVOCs, Metals, pH, TOC	3964479, 3964480, 3964481, 3964482	Arthur Kill
SED-14-C	560551.75	620339.35	12/17/2002	0.0-0.5	VOCs, SVOCs, Metals, pH, TOC	3964483, 3964484	Arthur Kill
SED-15-C	560796.87	619156.10	12/17/2002	0.0-0.5	VOCs, SVOCs, Metals, pH, TOC	3964477, 3964478	Arthur Kill
SED-16-C	560527.28	624127.87	12/17/2002	0.0-0.5	VOCs, SVOCs, Metals, pH, TOC	3964485	Arthur Kill
SED-17-C	561128.19	618327.72	12/17/2002	0.0-0.5	VOCs, SVOCs, Metals, pH, TOC	3964486	Arthur Kill
SED-18-C	560589.26	619847.67	12/17/2002	0.0-0.5	VOCs, SVOCs, Metals, pH, TOC	3964488	Arthur Kill
SED-19-B	559651.25	621828.37	3/21/2014	6.0-6.5	VOCs, SVOCs, Pesticides, PCBs, Metals, EPH, Grain Size, pH, TOC	JB62621-3	Woodbridge Creek Lower Reach
			9/20/2019	0.0-0.5	EPH, SVOCs, and Metals	1156543, 1156543DL	
				0.5-1.0	EPH and VOCs	1156544, 1156544DL	
SED-19-C	559648.49	621775.78	3/21/2014	7.5-8.0	VOCs, SVOCs, Pesticides, PCBs, Metals, EPH, Grain Size, pH, TOC	JB62621-4	Woodbridge Creek Lower Reach
			9/20/2019	0.0-0.5	EPH, SVOCs, and Metals	1156542, 1156542DL	
				0.5-1.0	EPH and VOCs	1156541	

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SED-20-A	555403.27	622500.70	2/28/2014	0.0-0.5	VOCs, SVOCs, Pesticides, PCBs, Metals, EPH, Grain Size, pH, TOC	JB60857-1	Spa Spring Creek Background
			10/8/2019	2.0-2.5	EPH, SVOCs, Metals, and VOCs	1170574	
SED-20-C	555405.55	622489.25	2/28/2014	0.0-0.5	VOCs, SVOCs, Pesticides, PCBs, Metals, EPH, Grain Size, pH, TOC	JB60857-2	Spa Spring Creek Background
			10/8/2019	2.0-2.5	EPH, SVOCs, Metals, and VOCs	1170573	
SED-21-A	555269.74	622437.45	2/28/2014	0.0-0.5	VOCs, SVOCs, Pesticides, PCBs, Metals, EPH, Grain Size, pH, TOC	JB60857-4	Spa Spring Creek Background
			9/24/2019	2.0-2.5	EPH, SVOCs, Metals, and VOCs	1158871	
SED-21-C	555266.66	622418.28	2/28/2014	0.0-0.5	VOCs, SVOCs, Pesticides, PCBs, Metals, EPH, Grain Size, pH, TOC	JB60857-3	Spa Spring Creek Background
			9/24/2019	2.0-2.5	EPH, SVOCs, Metals, and VOCs	1158870	
SED-22-A	559152.82	620785.58	9/25/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1159737	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	1159738	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1159739	
SED-22-B	559119.39	620740.18	9/25/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1159740	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	1159741	
				9.0-9.5	EPH, VOCs, SVOCs, Metals	1159742, 1159742DL	
SED-22-C	559109.88	620704.04	9/26/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1160981, 1160981DL	Woodbridge Creek Lower Reach
				0.5-1.0	VOCs	1160982	
				4.5-5.0	EPH, VOCs, SVOCs, Metals	1160983, 1160983DL	
SED-23-A	557326.52	623455.59	10/2/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1165596, 1165596DL	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1165597	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1165598, 1165598DL	
SED-23-B	557277.76	623449.28	10/2/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1165590	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1165591	
				6.5-7.0	EPH, VOCs, SVOCs, Metals	1165592, 1165592DL	
SED-23-C	557252.85	623406.55	10/2/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1165593	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1165594	
				5.5-6.0	EPH, VOCs, SVOCs, Metals	1165595, 1165595DL	
SED-24-A	556515.69	623444.97	10/4/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1167968	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1167969	
				5.5-6.0	EPH, VOCs, SVOCs, Metals	1167970, 1167970DL, 1167971, 1167971DL	

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SED-24-B	556485.67	623426.81	10/4/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1167972	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1167973	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1167974	
SED-24-C	556475.62	623385.36	10/4/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1167975, 1167975DL	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1167976	
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1167977, 1167977DL	
SED-25-A[3]	558408.83	621380.60	10/24/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1184595	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1184596	
SED-25-B[3]	558371.55	621313.39	10/24/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1183319	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1183320	
SED-25-C[3]	558341.74	621247.20	10/25/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1183317	Woodbridge Creek Upper Reach
				0.5-1.0	VOCs	1183318	
SED-SSBG-1	555524.13	622542.72	9/24/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1158872	Spa Spring Creek Background
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1158873	
SED-SSBG-2	555527.27	622527.90	9/24/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1158876	Spa Spring Creek Background
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1158874, 1158875	
SED-SSBG-3	555040.00	622318.51	9/24/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1158868	Spa Spring Creek Background
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1158869	
SED-SSBG-4	555040.26	622305.73	9/24/2019	0.0-0.5	EPH, SVOCs, Metals, TOC, pH and grain size	1158866	Spa Spring Creek Background
				2.0-2.5	EPH, VOCs, SVOCs, Metals	1158867	

[1] - As described in the approved 2019 SFSAP workplan, some sample intervals based on field detectable evidence of contamination, or if no evidence, from 2-2.5 feet below the sediment surface, whichever was first encountered.

[2] - Background Sediment Samples

[3] - Collected to 1-foot below sediment surface using Ponar Sampler due to presence of utilities in vicinity.